

WORLD METEOROLOGICAL ORGANIZATION

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**COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS
EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS**

SEVENTH SESSION

GENEVA, SWITZERLAND

27-30 MAY 2013

FINAL REPORT



WMO General Regulations

Regulation 42

Recommendations of working groups shall have no status within the Organization until they have been approved by the responsible constituent body. In the case of joint working groups the recommendations must be concurred with by the presidents of the constituent bodies concerned before being submitted to the designated constituent body.

Regulation 43

In the case of a recommendation made by a working group between sessions of the responsible constituent body, either in a session of a working group or by correspondence, the president of the body may, as an exceptional measure, approve the recommendation on behalf of the constituent body when the matter is, in his opinion, urgent and does not appear to imply new obligations for Members. He may then submit this recommendation for adoption by the Executive Council or to the President of the Organization for action in accordance with Regulation 9(5).

EXECUTIVE SUMMARY

The seventh session of the Expert Team on Satellite Utilization and Products (ET-SUP) was convened in Geneva, Switzerland from 27 to 30 May 2013.

The primary objective of the session was to advance the work programme defined by the World Meteorological Organization (WMO) Commission for Basic Systems (CBS) as concerns in particular the promotion of access and use of satellite data by WMO Members in support of all WMO programmes and WMO co-sponsored programmes. In particular, the Team framed its consideration within the context of the key initiatives of the WMO Information System (WIS), the WMO Integrated Global Observing System (WIGOS) and the Global Framework for Climate Services (GFCS).

A key area of focus for the meeting was the Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) for Nowcasting (SCOPE-Nowcasting) initiative; the pilot projects were reviewed and refined across the broad application areas defined within the concept including basic nowcasting, volcanic ash products for aviation, and ocean products. SCOPE-Nowcasting was also discussed in the joint session with the Expert Team on Satellite Systems (ET-SAT) composed of satellite agency representatives, which provided some guidance on refinement of the pilots.

The meeting also considered the results of the WMO 2012 Survey on the Use of Satellite Data, making a number of recommendations for future surveys and setting goals for analysis of the survey results by the team. This analysis will form guide the future work of the Team, in particular around training and capacity development efforts.

The meeting recognised the value of regional efforts to gather satellite data requirements and also acknowledged the complementary nature of these efforts to the globally-focused activities of ET-SUP. The Team made a number of recommendations to ensure that regional and global efforts are coordinated to provide the best possible outcome.

Among its other major outcomes, the session:

- Identified a number of issues relating to satellite data formats and recommended future work to address these;
 - Provided guidance for accessing and using new satellite capabilities;
 - Discussed, and provided guidance to, advancing global data dissemination through the Integrated Global Data Dissemination Strategy (IGDDS), the Regional ATOVS Retransmission Services (RARS) and GEONETCast;
 - Reviewed a number of case studies for the application of satellite data in support of climate services in the initial priority areas of the GFCS, and set out a programme of work for expanding these case studies;
 - Discussed important developments in user training and capacity building, including the Virtual Laboratory for Education and Training in Satellite Meteorology, the GOES-R Proving Ground programme, Committee on Space Research (COSPAR) activities, and in relation to space weather-related applications.
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From left: Xiang Fang, Sergei Uspensky, Sally Wannop, Ignatius Gitonga Gichoni, Hiroshi Kunimatsu, Volker Gärtner, Lars Peter Riishojgaard, Richard Eckman, Stephen English, Stephan Bojinski, Luiz Machado, Anthony Rea, Simon Keogh, Jérôme Lafeuille, Jean-Louis Fellous, Daniele Biron.

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

The meeting was opened at 9.00 on Monday 27 May 2013 in Room 7 Jura at the World Meteorological Organization (WMO) Headquarters, Geneva, Switzerland, by the Chair of ET-SUP, Anthony Rea (Bureau of Meteorology, Australia).

The objective of the session was to advance the new two-year work programme (see Appendix I) defined by the WMO Commission for Basic Systems (CBS) at its 15th session in 2012 which re-constituted ET-SUP. The work programme of ET-SUP concerns in particular the promotion of access and use of satellite data by WMO Members in support of all WMO programmes and WMO co-sponsored programmes. It also involves exploring the use of satellite data from research and demonstration missions for applications. Fostering the generation of harmonized datasets, and promoting coordinated training in the use of satellite data are further priorities.

Dr Peiliang Shi welcomed all participants of ET-SUP on behalf of WMO, noting the key importance of the Team in light of the challenges many WMO Members face in making optimum use of the substantial satellite assets available today through the space-based Global Observing System. The five WMO priority areas during this financial period – (i) further integration of observing systems in the WMO Integrated Global Observing System (WIGOS), (ii) the development of effective climate services within the Global Framework for Climate Services (GFCS), (iii) aviation meteorological services, (iv) disaster risk reduction, and (v) training and education – all have important satellite-related components which require effective utilization of the data at hand.

The Chairman then invited all participants to a tour-de-table to introduce themselves (see list of participants in Appendix II). Given the presence of several new members on the Team, he stressed the importance of this session to foster cohesion and collaboration in pursuit of its work plan assigned by CBS.

1.2 Adoption of the agenda

The proposed provisional agenda was adopted without modification (Appendix III).

1.3 Working arrangements for the session

The work of the session was conducted in Plenary and in a series of break-out groups. A joint session with the Expert Team on Satellite Systems (ET-SAT) was held on Wednesday 29 May (see item 11). All working documents were posted online on the meeting webpage ahead of the session: <http://www.wmo.int/pages/prog/sat/meetings/ET-SUP-7.php>.

2. CHAIRMAN'S REPORT

The ET-SUP Chairman, A. Rea, provided his views and priorities in advancing the Team's work programme (see Appendix I), and gave specific guidance for the session. He stressed the importance of coordination of satellite utilization matters at the level of WMO, given the broad coverage of the globe of meteorological satellites which are therefore used almost universally by national meteorological and hydrological services. All nations benefit directly or indirectly from satellite in their applications, and further benefit can be obtained through cooperation and collaboration. The fact that the same data can be used by multiple users is a great facilitator of cooperation.

The situation of his home institution, the Australian Bureau of Meteorology, was serving as a good example of being a user highly dependent on satellite data coverage for its services, and at the same time being dependent on sustained, coordinated provision of data from international satellite operators since Australia was not operating its own meteorological satellites. A. Rea singled out the Sustained Coordinated Processing of Environmental Satellite Data (SCOPE) for

Nowcasting (SCOPE-Nowcasting) initiative as a nucleus for regional coordination. The advent of the new generation of geostationary satellites, including Himawari-8/9, GOES-R, FY-4, GEO-KOMPSAT-2A and Meteosat Third Generation poses opportunities but, equally, challenges for many users in all WMO Regions. More specifically, implications of the multiplicity of systems covering WMO Region II (RA II) and RA V require addressing in a timely and adequate fashion.

The agenda of the meeting reflects the various elements through which effective utilization of satellite data should be achieved. ET-SUP should further embark on exploring pathways on how to utilize current or upcoming research satellites effectively for operational purposes; and facilitate effective data exchange in response to user requirements, such as through the NAEDEX-APSDEU mechanism and regional requirements groups.

2.1 Outcome of relevant meetings since ET-SUP-6

The Secretariat provided a short report on the outcome of major ET-SUP-relevant meetings and activities since the last ET-SUP session in December 2011. These include:

- the fifteenth session of CBS which was held in Jakarta, Indonesia in September 2012. With relevance to ET-SUP, CBS adopted:
 - Recommendation 1 (CBS-15) - Implementation and sustainability of the database of Observation Requirements and Observing Capabilities, requesting “To assign priority for the implementation of the database of Observation Requirements and Observing Capabilities within overall WIGOS Framework Implementation Plan” (CBS welcomed the operational implementation of the Observing Systems Capability Analysis and Review Tool (OSCAR), as the first component of the future WIGOS Information Resource);
 - Recommendation 3 (CBS-15) – Amendments to the Manual on the Global Observing System (WMO-No. 544), Volume I, (Section 4 on space-based sub-system), requesting these amendments to be included in the Manual on the Global Observing System (GOS), or in the corresponding WIGOS Regulatory Material; - *these amendments include important elements from a satellite user perspective*
 - Recommendation 5 (CBS-15) – Procedure for documenting regional requirements for satellite data access and exchange¹; - *in accordance with this procedure, all regional associations have been approached to implement such regional requirements definition mechanisms*
 - CBS furthermore endorsed the “Guidelines for ensuring user readiness for new generation satellites”². *These guidelines were then brought to the attention of regional associations and introduced in regional satellite user conferences*
- the 65th WMO Executive Council which was convened from 15 to 23 May 2013. It approved the recommendations 1 and 3 presented by CBS (see above), and two updated versions of Resolutions 4 and 5, presented by the Space Programme:
 - “Avoiding gaps in essential space-based observations”, with an added reference to space weather observations,
 - “Regional requirements for satellite data access and exchange”.

¹ http://www.wmo.int/pages/prog/sat/documents/SAT-GEN_CBS-15-ProcedureRegionalDataAccessReq.pdf

² http://www.wmo.int/pages/prog/sat/documents/SAT-GEN_CBS-15-GuidelineUserReadiness.pdf

During the Executive Council, a side-event was organized on the subject of “User readiness for new generation satellite systems”, where JMA, NOAA, CMA, EUMETSAT and the Bureau of Meteorology shared their experience and plans for user preparedness to the forthcoming generations of geostationary satellites, either from a satellite operator’s or from a user’s standpoint.³

2.2 Status of previous ET-SUP Actions

All Actions identified at previous sessions of ET-SUP were completed (see ET-SUP-7/Inf.2), except for the following (the conclusions drawn at this session are given in **BOLD**):

Action 6.6: ET-SUP highlighted the importance of maintaining discussions with NOAA, INPE, EUMETSAT, GEO and other interested parties to define a roadmap towards a sustainable, enhanced, DVB-S service covering RA III and RA IV. (Due date: November 2012)

CLOSED; NEW RECOMMENDATION 7.17 MADE AT ET-SUP-7.

Action 6.9: A. Mostek to liaise with NESDIS about developing a portal or other form of guidance on available products from DMSP (such a portal could be ultimately part of the Product Access Guide). (Due date: 15 April 2012)

CLOSED. SUPERSEDED.

Action 6.10: EUMETSAT to report at CGMS-40 on the Multi-Mission Administration Message (MMAM) as a possible matter of harmonization within CGMS. (Due date: CGMS-40)

CLOSED. NO ACTION TAKEN AT CGMS-40.

Action 6.11: EUMETSAT to investigate the possibility of providing frequent Meteosat image sectors for RA III/IV in the framework of the EUMETSAT data policy, for consideration as candidate product for GEONETCast-America. (Due date: 30 June 2012)

CLOSED. DISCUSSION ONGOING.

Action 6.18: A. Rea and L. Machado to develop a discussion paper for a SCOPE-NWC Pilot Project focused on aviation products. (Due date: 30 April 2012)

CLOSED. SUPERSEDED BY DISCUSSION AT ET-SUP-7 ON SCOPE-Nowcasting.

Action 6.26: VLab TSO to ensure that all CoE websites are up-to-date, reflecting the ‘look and feel’ of the VLab homepage (including the VLab logo). (Due date: 1 March 2012).

CLOSED. NEEDS ONGOING ATTENTION.

Action 6.28: VLMG Co-Chair to contact CMA VLab CoE to arrange for a distant lecture on the FY-3 product suite for the benefit of all Regions. (Due date: 21 February 2012)

CLOSED, NEW ACTION 7.19.

Action 6.29: O. Milekhin to contact the VLab CoE at the Hydrometeorology University of St. Petersburg (Russian Federation) to arrange for a distant lecture on the Meteor-M product suite for the benefit of all Regions. (Due date: 21 February 2012)

CLOSED, NEW ACTION 7.20.

Action 6.30: A. Mostek, with assistance from COMET and the WMO Space Programme office, to investigate whether ESRC (as a portal) and MetEd (as a repository of training material) can be registered in appropriate ways in the WIS, to allow for broad discovery of their content. (Due date: 1 March 2012).

REMAINS OPEN.

³ <http://www.wmo.int/pages/prog/sat/meetings/EC65-SideEvent-UserPrep.php>

Action 6.32: ET-SUP members who are product providers to create product pages in accordance with the agreed categorization, for inclusion in the product access guide. (Due date: 31 December 2012)

CLOSED. SUPERSEDED.

Action 6.33: VLab to develop a draft page for guidance on the use of satellite products in support of high-impact events management, with a view to include it in the Product Access Guide. (Due date: 1 May 2012)

CLOSED.

ET-SUP Permanent Action P.1: ET-SUP Members will inform the WMO Space Programme office of any issues related to NRT access, documentation, software tools, and service notifications for R&D satellites of primary interest for operational users, in view of addressing these issues at ET-SAT and with relevant satellite operators.

CLOSED. Standing agenda item of ET-SUP sessions.

ET-SUP Permanent Action P.2: The VLab Technical Support Officer, on behalf of the WMO Secretariat, should regularly ask the Centres of Excellence for status reports on their activities, especially regarding training and satellite data utilization in their respective regions.

CLOSED. Done within the VLab Management Group.

ET-SUP-5 Action 5.10: WMO Space Programme office, through the VLMG, to seek input from various areas of the world to illustrate the benefits of satellite data and products for various application areas. (Due date: End 2010)

CLOSED. Addressed by GFCS case studies.

3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS

The Chairperson of the CBS Open Programme Area Group on Integrated Observing Systems (OPAG IOS), L. P. Riishojgaard, informed the Expert Team on the expected role of ET-SUP in the context of OPAG IOS. CBS sees the Team as being a very important interface to satellite data users and space agencies.

He emphasized that WIGOS is an expansion and modernization of the WMO Global Observing System (GOS) into other application areas and observing systems. Recently, good work has been progressing in the development of the necessary WMO Regulatory Material, on Quality Management and on Regional implementation initiatives according to the WIGOS work programme, which is described in the WIGOS Framework Implementation Plan. The Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) developed a checklist for national implementation of integrated observing systems.

Another area of progress is the development of databases of observing systems and user requirements at the WMO Secretariat, through OSCAR and the WIGOS Information Resource (encompassing OSCAR, including the future surface-based capability module OSCAR/Surface, and information on standards and regulatory material). Attention should be paid on how to maintain these resources over the long term.

A valuable source of information on the relative importance of sources of observational data is provided by the WMO Workshops on the Impact of Various Observing Systems⁴, for NWP. The GOS has developed into a system whose performance is quite resilient against the loss of any single observation or observation type. L.-P. Riishojgaard emphasized the importance of the ADM-Aeolus mission providing an entirely new measurement principle for vertically-resolved winds, and

⁴ http://www.wmo.int/pages/prog/www/OSY/Meetings/NWP5_Sedona2012/Final_Report.pdf.

the Team should keep a watching brief on plans for data formats and dissemination since the learning curve using new types of data may be steep.

In general, the Team should pay due attention to measures alleviating the burden associated with data volumes and data formats.

A. Rea noted the importance of the Impact Workshops given the pressure on observing system budgets. L. P. Riishojgaard informed that the recent Impact workshop saw participation by programme managers responsible for observation budgets, reflecting the success and visibility of these events. S. English noted that despite resilience of the overall observing system, no saturation level has as yet been demonstrated regarding the impact of any individual observation.

4. UPDATE ON WIGOS AND GFCS

This session provided updated reports on two major priority areas of WMO: the WMO Integrated Global Observing System (WIGOS) and the Global Framework for Climate Services (GFCS). WIGOS is an over-arching framework for the coordination and evolution of WMO observing systems and the contributions by WMO to co-sponsored observing systems. Main goal of the intergovernmental GFCS is to enable better climate risk management by coordinated, sustained and quality-controlled delivery of climate information to societal sectors at global, regional and national scales.

4.1 WIGOS

S. Bojinski provided an update on the WIGOS framework and its implementation along the following six priority areas:

- Coordinated design, planning and optimized evolution of WIGOS component observing systems (including space-based observing systems)
- Observing System Operation and Maintenance
- Quality Management
- Standardization, System Interoperability and Data Compatibility
- Development of the WIGOS Information Resource including OSCAR
- Data discovery, delivery and archival

It was noted that WIGOS was intended to improve data access for Members through greater integration of component observing systems that will continue to be owned and operated by a diverse array of organizations and programmes. Satellite systems contributing to the GOS are already well integrated and a key element of WIGOS. More integration would allow streamlining resources where necessary since agencies could no longer afford to run separate observing systems for separate applications. OSCAR remains a key contribution to inform the integration process, and a cornerstone of the planned WIGOS Operational Information Resource (WIR).

Following the approval of the WIGOS Framework Implementation Plan by the 64th Executive Council in June 2012, actions have been taken by technical commissions, regional associations, and through dedicated task teams to advance implementation. All WMO Regions are now developing Region-based WIGOS Implementation Plans, reflecting their specific observing needs and priorities.

4.2 GFCS

On behalf of the Director of the GFCS Office at WMO, Filipe D. F. Lucio, S. Bojinski briefed the Team on the Global Framework for Climate Services (GFCS). Overarching goals of GFCS are to reduce the vulnerability of society to climate-related hazards and thus to advance key global development goals. This should be achieved through mainstreaming the use of climate information

in decision-making, strengthening the engagement of providers and users of climate services, and maximizing the utility of existing climate service infrastructure.

For the first time in the history of WMO, an extraordinary Congress was convened in October 2012 to decide on the WMO engagement in the GFCS. Congress decided to establish an Intergovernmental Board on Climate Services (IBCS) to ensure coordination at the regional and global levels and to engage the entire UN system and other stakeholders to deliver needs-based climate services all over the world. The Congress also approved a resolution on the implementation of the Global Framework for Climate Services. Eight fast track projects described in the implementation plan⁵ have been put in place to showcase the benefits of climate services for the improvement of livelihoods, in the four priority areas: agriculture and food security, water, health and disasters.

The Intergovernmental Board meets for the first time on 1-5 July 2013 in Geneva, to decide on: its membership; sub-structures in the areas of Observations and Monitoring - Research, Modelling and Prediction - Climate Services Information System - and User Interface Platform; approval of priority projects; principles for recognizing projects contributing to the GFCS; and the establishment of frameworks for climate services at national levels.

5. WMO 2012 SURVEY ON THE USE OF SATELLITE DATA

S. Bojinski gave an overview of key results from the WMO 2012 Survey on the Use of Satellite Data⁶, commissioned by ET-SUP and carried out by the Secretariat in order to collect information on the availability and use of satellite data and products by users globally, and to identify any areas for improvement and remedial action. This is part of the work programme of ET-SUP.

The total number of valid responses received was 227 (originating from 95 WMO Member countries) of which 127 (56%) were provided by National Meteorological and Hydrological Services (NMHS), 31 (14%) from other operational governmental institutions, and 60 (26%) from institutions with a research/academic mandate.

Target audience of the survey were users in NMHSs of the WMO Member states and territories, as well as other satellite users worldwide active in the fields of meteorology, climate, hydrology, disaster risk reduction and related environmental applications. In detail, the survey includes comprehensive global and Region-based information on (i) the use of satellites, (ii) access to Satellite data, (iii) current and planned application of satellite data, (iv) challenges in using satellite data, and (v) training needs and methods. Reference to results from earlier survey led by ET-SUP was made where possible.

Participants briefly discussed these results in plenary and a break-out session and provided guidance on future action by ET-SUP and remedial actions in response to reported deficiencies. The session also discussed format and timing of future surveys of this kind.

The Team provided a number of comments on the conclusions of the survey report (p. 26 therein):

- (i) If regional surveys are being undertaken, particular attention should be placed on countries that did not respond to the 2012 global survey;
- (ii) The distinction of users into NMHS/operational and research/academia is useful, however future surveys should consider a further breakdown by user types;
- (iii) The survey should be extended where possible to communities of practice associated with the GEO Societal Benefit Areas.
- (iv) Targeted surveys/ interviews are of potential value; however, they require resources which are not readily available. In addition, ITWG, IWWG are conducting surveys themselves, and ET-SUP should draw upon this work where possible.

⁵ http://www.wmo.int/pages/gfcs/ip_en.php

⁶ http://www.wmo.int/pages/prog/sat/documents/SAT-PUB_SP-9-Survey-Report-2012.pdf

It was commented that some respondents may not be aware of their reliance on satellite products if they were using blended or integrated products, possibly leading to lower utilization statistics of such products (such as on snow cover). The survey results were considered as helpful guidance, especially for designing future training events.

The Team agreed that global surveys should be conducted roughly every four years; their results should help guide the work of ET-SUP; in addition, the results should be used to inform Region-based efforts to gather requirements and improve satellite utilization. Regional surveys should endeavour to build on the results of the global survey, rather than duplicating it.

Recommendation 7.1: Global WMO surveys on the use of satellite data should be conducted roughly every four years.

Recommendation 7.2: Region-based efforts to improve the use of satellite data by Members should be informed by data from (i) global surveys and, as necessary, (ii) Region-specific surveys; case and country-specific follow-up is particularly encouraged.

The Team supported the use of online techniques and recommended consideration of using social media to connect with users in future surveys. Suggestions on the format of survey questions were made, such as “To what extent do you think you have a need for training?” rather than “Do you have a training need?”, or “How satisfied are you with...?”/“Why did you give this answer...?”/“How could this be improved?”

Action 7.1: All ET-SUP members to analyze the WMO 2012 Survey on the Use of Satellite Data, with particular focus on results specific to their Region; Members to provide feedback to the ET-SUP Chair and the Secretariat; Deadline: 1 Sep 2013.

6. DATA ACCESS AND EXCHANGE REQUIREMENTS

Under this item, the session discussed reports on international satellite data exchange coordination mechanisms including regional efforts to determine user requirements for access to satellite data and products. Briefings were given on existing coordination mechanisms, the suite of required data products, dissemination techniques, and software tools. This involves the North America-Europe Data Exchange (NAEDEX) and Asia-Pacific Satellite Data Exchange and Utilisation (APSDEU) fora, as well as WMO Region-based coordination initiatives. Updates from Region I, Region II (WIGOS Project), Region III/IV and Region V were received in this regard. ET-SUP serves as an umbrella group for Region-based coordination mechanisms for satellite data access and exchange.

6.1 NAEDEX-APSDEU

The joint NAEDEX-APSDEU (North America Europe Data Exchange – Asia/Pacific Satellite Data Exchange and Utilization) meeting took place at the Met Office in Exeter on 22-26 October 2012. In the main, NAEDEX provides an interface between major Numerical Weather Prediction (NWP) centres (such as DWD, MSC, MetOffice, MétéoFrance, ECMWF) and satellite operators, however discussions go beyond exchange of satellite data only. APSDEU has modelled the NAEDEX example. A number of actions resulted from both meetings that were briefly presented for information. The goal of the group is to identify the data exchange requirements and to provide solutions to deficiencies in data dissemination or point-to-point distribution. A detailed document is maintained listing all available data, the current requirements of centres and the current status of, or plans for dissemination (see http://www.nws.noaa.gov/data_exchange_mtgs). These both help to identify when a dataset exists but is not available to all centres, and also when requirements no longer exist. The main purpose of the meetings is to review and update this exchange document, and most actions relate to clarification of the information and resolving issues identified by review

of the document. At the joint meeting, additional Asia-Pacific requirements for the attention of Europe/North America and vice versa were compiled. However there is also a useful general exchange of new information on scientific data use.

In the discussion, it was emphasized that the NAEDEX and APSDEU mechanism have been successful since they had a clear focus and operated at the working level. Although there is value in joint meetings, the two mechanisms should remain separate entities. Further to a question from L. Machado about participation in the meetings, the question arose which user types should be part of discussions in NAEDEX-APSDEU. It was suggested that users (“specialized users”) with an interest in global datasets, running global models should be the primary audience. Regional and/or national-focussed users (“general users”) should be served by Region-based requirements coordination mechanisms (see item 6.2).

Action 7.2: S. English and A. Rea to facilitate the invitation by CMA of an INPE/CPTEC observer to the next NAEDEX-APSDEU meeting in China 2014.

6.2 Regional coordination mechanisms and user perspectives

6.2.1 Procedure on Regional Requirements for Satellite Data Access and Exchange

Recognizing the challenges of access to satellite data in light of the dramatic expected increase in the volume of satellite data and products available over the next 5-10 years, and the regional diversity of needs and capabilities of the various types of users (e.g., high-speed vs. low-rate) call for differentiated data access solutions and Region-based expression of user requirements for data access and exchange.

WMO through its Commission for Basic Systems (CBS) considers among its priorities “to organize the formulation of data requirements and the dialogue between data users and providers.” CBS and subsequently the 65th WMO Executive Council 65 endorsed the establishment of Region-based mechanisms to document and maintain requirements for data access and exchange, with participation by users and satellite providers. These follow, and build on, existing mechanisms in RA I, II, III/IV, and V.

S. Bojinski briefed the group on the Procedure as approved by CBS and subsequently by the WMO Executive Council at its 65th session.

The Team discussed a number of issues relating to the operation and reporting mechanisms for coordination groups gathering regional requirements for satellite data access and exchange. Issues discussed included:

- (i) Existing global coordination groups;
- (ii) Naming conventions of groups;
- (iii) The need for inter-regional coordination;
- (iv) The existence of a mandate;
- (v) Focus of the groups – whether this should be purely on satellite data, or any data disseminated via satellite-based (DVB-type) services;
- (vi) Integration with other WIGOS-type regional mechanisms;
- (vii) The need to identify training needs and support;
- (viii) The need to ensure sustainability of groups and obtain commitments from providers;
- (ix) Other complementary mechanisms for coordinating GTS data provision; and
- (x) Processing and visualization systems.

The team as a whole reviewed the Terms of Reference for these groups and agreed that they were still valid.

Recommendation 7.3: Regional mechanisms fostering coordination of requirements for satellite data access and exchange should be strengthened by collocating, where possible:

- (i) region-based satellite user conferences;**
- (ii) regional training events covering**
 - a. current and upcoming satellite systems,**
 - b. enabling users to utilize data from these systems,**
 - c. practical information on data access, visualization and analysis tools, and**
- (iii) meetings of Regional Satellite Data Requirements Groups.**

Recommendation 7.4: WMO has insufficient resources to fully support such events, therefore Members of the Regional Satellite Data Requirements Groups including satellite providers should consider providing additional resources.

Recommendation 7.5: Regional Satellite Data Requirements Groups should, at least initially, focus on access and exchange of (i) satellite data, or (ii) any data disseminated via satellite-based (DVB-type) services. As appropriate, the Groups should also work on a Region-based data dissemination plan, with cost/resource-sharing options to ensure sustainability of service.

Recommendation 7.6: Regional Satellite Data Requirements Groups should regularly report to ET-SUP.

Action 7.3: Regional Satellite Data Requirements Groups should each designate a chair or co-chairs, if not already in place. Deadline: 1 Sep 2013.

Action 7.4: S. Wannop, L. Machado, A. Rea, H. Kunimatsu and X. Fang to agree on a common template for gathering requirements for data access and exchange, based on their respective practices. Deadline: 1 Dec 2013.

6.2.2 RA I

RAIDEG

S. Wannop provided an overview of the current work of the WMO RAI Dissemination Expert Group (RAIDEG) which was established in 2010 to discuss and review data access requirements for Region I. In particular, the Group focuses on updates to the EUMETCast-Africa Dissemination Baseline. It comprises of the following members:

- Regional NMHS's representation: Cameroon, Kenya (Chair), Mauritius, Morocco, Senegal, South Africa
- Continental representation: ACMAD
- Regional training representation:
 - Niger, Kenya, South Africa & Morocco VLab 'Centres of Excellence'
- EUMETSAT Secretariat representative
- WMO Secretariat representative

Updates to this baseline are put forward for approval by the EUMETSAT Council and are subsequently implemented on EUMETCast. RAIDEG is the focal point for enhancements to reception station equipment provided through continental wide projects. Additionally, RAIDEG interface with those responsible for training services provided to the Region.

Current topics of key importance to the Group, which next meets on 11-12 June 2013 at WMO HQ, are:

- Ongoing maintenance of existing reception station equipment
- Levels of training material and support, for example in the use of NWP model output

- Communication with the NMHSs they are mandated to represent and other user communities within the region.

Challenges discussed by the Group include data utilization, identifying requirements from communities outside of satellite meteorology, training and technical assistance in upgrading receiving equipment. Equipment manufacturers should be more involved on issues related for example to workstation upgrades associated with updated data streams. A request for quotation has been issued by EUMETSAT for a one-off upgrade to the PUMA stations.

To address the point about identifying requirements, WMO has invited representatives from its Technical Programmes, such as JCOMM, SWFDP, agriculture, aviation and climate, to attend the next RAIDEG meeting to facilitate a dialogue between relevant parties.

KMD perspective

I. Gitonga provided a KMD perspective on current issues faced by KMD (and other NMHSs in RA I) associated with using the SYNERGIE data processing and display system. These should be brought to the attention of the user-provider dialogue maintained in RAIDEG. He informed that the inclusion of vegetation products in the KMD bulletin required an upgrade of the SYNERGIE system.

A number of recommendations were outlined by I. Gitonga to be considered by RAIDEG at its 4th meeting in June 2013.

V. Gärtner stressed the importance of the RAIDEG and commented that concerted expression of user requirements in support of programmes and policies through such regional groups provided the basis for the justification for satellite providers to disseminate their datasets.

6.2.3 RA II WIGOS Project

H. Kunimatsu informed on activities undertaken in the RA II WIGOS Project to develop support for NMHSs in satellite data, products and training. He reported on accomplishments of the third and fourth phases of the Project, including regular issuance of newsletters of regional relevance, completion of a user survey, and organization of the Asia/Oceania Meteorological Satellites Users' Conferences.

Results of a 2011/2012 user survey to monitor the availability and use of satellite data and products in RA II are available: http://www.wmo.int/pages/prog/sat/documents/RA-2-PP_Newsletter-Vol3-N2.pdf.

The value of this the Project was underlined by ET-SUP, in particular since it emerged from a need identified in the Region, by the Region.

In subsequent discussions, ET-SUP stressed the importance of appropriate follow-up to the findings of the survey by the RA II WIGOS Project, especially when deficiencies and challenges were reported by satellite data users in RA II. These could be addressed through dedicated training, technical assistance, or through workshops and regional Conferences.

It was further suggested to take steps to invite Lao PDR to become a member of the RA II WIGOS Project, given the emerging interest in utilization of satellite data in this country. All efforts should be taken to ensure that all RA II Members have the opportunity to contribute to the Project.

Action 7.5: RA II WIGOS Project co-leads (JMA and KMA) to address the deficiencies and challenges reported by Members in RA II in response to the 2011/2012 user survey. Deadline: 4th Asia/Oceania Meteorological Satellites Users' Conference in Oct 2013 (for development of a work plan)

Action 7.6: WMO Secretariat, in collaboration with RA II WIGOS Project co-leads (JMA and KMA), to invite Lao PDR to become a member of the Coordination Group for the Project. Deadline: 1 Sep 2013

6.2.4 RA III/IV

L. Machado recalled the evolution of satellite data requirements documentation in the Americas, and posed key questions to be addressed by the Coordination Group. This issue has been addressed for RA III and RA IV, through a Satellite Data Requirements Task Team established in June 2009 by the Secretary General of WMO.

The Task Team prepared an inventory of dissemination systems available in Regions III and IV with details on their coverage, data rate, and provisions for sustainability of these systems. The Secretary-General of WMO invited Members in RA III and RA IV to nominate candidates for a standing regional coordination group.

The first meeting of the coordination group was held in early April 2013 in the United States during the NOAA Satellite Conference for Direct Readout, GOES/POES, and GOES-R/JPSS users; the group currently has representatives from seven Members in the Americas (Canada, Trinidad and Tobago, Venezuela, Brazil, Argentina, Chile, Colombia), and from the satellite operators NOAA NESDIS and EUMETSAT.

L. Machado emphasized the need for a distinction between specialized users and general users when defining requirements, the former mostly using level 1 data (calibrated radiances), and the latter mostly interested in products (level 2 and higher). He outlined the different data dissemination systems in the Region and noted that all have limitations.

Issues remain in integrating and sustaining GEONETCast-Americas and EUMETCast-Americas. In a May 2013 letter to NOAA NESDIS, INPE indicated their commitment to contribute financially to the maintenance of the GEONETCast-Americas and EUMETCast-Americas broadcast services.

In the discussion, the regional character of such groups was valued by the Team, given (i) the interest of many general users for data being mostly limited to national and regional scales, and (ii) the nature of DVB-S data dissemination systems being available regionally. It was also stressed that satellite operators have an inherent interest in catalyzing requirements-setting through regional groups.

6.2.5 RA V (TT-SUR)

A. Rea mentioned the efforts ongoing in the Task Team on Satellite User Requirements (TT-SUR) which was formed in RA V in 2012. These include:

- (a) The TT-SUR has developed a work plan of activities for 2012 and 2013;
- (b) Experts contributing to the Team have held a number of teleconferences to report on their activities;
- (c) The TT-SUR held a face-to-face meeting of some of its members during the NOAA Satellite Conference in April 2013. This turned out to be a fortunate opportunity as very few of the members of TT-SUR were able to attend the meeting of its parent group (RA V Working Group on Infrastructure) in Melbourne later in April 2013;
- (d) The Coordinating Group on Meteorological Satellites (CGMS) has provided a point of contact with satellite operators (NOAA, JMA, CMA, KMA, EUMETSAT), although the TT-SUR has yet to contact them to obtain their input and guidance.

The team aims to have a draft table of priority requirements ready for final review in a side meeting at the 4th Asia Oceania Meteorological Satellite Users' Conference to be held in Melbourne early October 2013. In that regard, it is proposed that WMO support attendance of Task Team members plus a number of representative satellite users from RA V, noting the potential for such attendees to benefit from a training event in Melbourne as well as the conference itself.

ET-SUP appreciated the efforts of the Team in collecting responses to the WMO 2012 Survey on the Use of Satellite Data, which has led to a relatively high number of replies from RA V compared to previous surveys.

Representation on the Team from a broader range of RA V Members should be encouraged. ET-SUP further noted that caution should be applied not to duplicate existing requirements definition processes in other Regions and at the global level.

7. SATELLITE DATA FOR APPLICATIONS

An overview of the use of satellite data in different application-oriented contexts was provided under this agenda item. The focus was on satellite data used to support sustained/operational nowcasting, climate, marine (including from JCOMM), and aviation applications. In addition, under 7.2 (Climate), the Secretariat gave a briefing on the Architecture for Climate Monitoring from Space, and on possible case studies for connecting the Architecture to climate services.

7.1 Nowcasting

A. Rea explained the value of satellite data for a range of nowcasting applications in the Australian Bureau of Meteorology (BoM). The synoptic view on precipitation using rain gauges and rain radar networks shows significant gaps over Australia. This makes a good case for the use of complementary satellite information, for example for nowcasting.

Geostationary data sources are chiefly MTSAT-2, FY-2 East and West. Some attempts have been made to fuse data from FY East and MTSAT-2 but have been of limited success due to parallax errors, differences in instrument characteristics, and calibration and navigation differences.

Polar-orbiting data are received directly from the NOAA series, Metop, Suomi-NPP, Terra and Aqua. The Bureau also has plans for reception of FY-3 data in the next 12 months. However, for nowcasting applications the application of polar orbiting data is limited due to the relatively small number of overpasses. The exception to this is Antarctic operations, where polar orbiter data are used extensively.

The primary product for nowcasting is imagery, which is used for tropical cyclone tracking and intensity analysis, and for detection of thunderstorms and other phenomena. In addition to imagery, a number of nowcasting products are generated in real time. The key products are Fog and Low Cloud and Volcanic Ash.⁷

The fog and low cloud product is generated from both MTSAT and NOAA imagery, with a MODIS version under development. The lower resolution of the MTSAT product reduces its utility to some degree. The product is primarily used to detect the extent of morning fog formation near airports, as fog incidents are extremely disruptive and costly.

⁷ NOAA provides fog and low cloud products from MODIS and is developing one for Suomi-NPP – see CIMSS satellite blog for several examples (<http://cimss.ssec.wisc.edu/goes/blog/archives/category/fog-detection>).

The volcanic ash product is generated from MTSAT and NOAA imagery, both of which are received locally at the Darwin Volcanic Ash Advisory Centre. Window channel differencing is used to highlight volcanic eruptions.⁸

The use of satellite-based information is expected to increase with the advent of Himawari-8 (with its 10-minute image sampling frequency). Work is ongoing between BoM and JMA to exploit synergies in product generation.

7.2 Climate/GFCS

In this paper, S. Bojinski outlined case studies that could be used to demonstrate the direct or indirect value of satellite data for climate services, addressing the priority societal benefit areas of the Global Framework for Climate Services: food security, water, disaster risk reduction, health. Starting from the end users' perspective and their needs, these case studies are intended to validate, and inform, the end-to-end Architecture for Climate Monitoring from Space and its further development.

Core elements of a climate service include:

- Monitoring
- Reanalyses
- Attribution of phenomena & events, including extremes
- Indicators / indices
- Forecasts (predictions and projections)

Downstream elements of climate services could be for instance:

- Seasonal climate outlooks (3-6 months) over South East United States, to inform livestock and fruit farmers
- Expected trend in annual rainfall over the next 3 decades in support of hydropower infrastructure decision-making in India
- Assessment of whether the recent drought in the Greater Horn of Africa, by its length/severity has been a 1 in 10, 1 in 30, 1 in 50 years event (to inform building resilience against famine and manage risks).
- Answer to: How will sea-ice parameters change along the North-East passage over the next 20 years in September?

The Implementation Plan for the Global Framework for Climate Services² and its Annex on Observations and Monitoring³ recognize the Architecture for Climate Monitoring from Space and recognize that “The development of an architecture for sustained climate monitoring from space will bring the same structures and rigour to climate monitoring that are currently in place for weather monitoring and forecasting. The definition and implementation of the architecture will be based on requirements established by GCOS for the subset of ECVs that can be monitored from space. The architecture will be defined as an end-to-end system, involving the different stakeholders, including operational satellite operators and R&D space agencies, the Coordination Group for Meteorological Satellites (CGMS), the Committee on Earth Observation Satellites (CEOS), GCOS, WCRP, and GEO.”

S. Bojinski explained the linkage between the logical view on the Architecture and the identification of service-driven observation requirements. He emphasized that at the WMO level, there was currently no process in place to systematically capture GFCS-related service requirements that could be translated into product, observation and instrument requirements.

⁸ Examples of NOAA imagery and products from MODIS, SNPP and GOES are found at <http://cimss.ssec.wisc.edu/goes/blog/archives/category/volcanic-activity>. Note that training materials on tracking of Volcanoes from satellite from VISIT and COMET are available and can be found at ESRC (<http://www.meted.ucar.edu/esrc/>).

It should further be noted that:

- The WMO Rolling Review of Requirements (RRR) process nominally encompasses observations and products up to level 2 (“technology-free”);
- However some requirements (e.g., GCOS) are a mix of level 2 and level 3;
- Capturing higher-level product requirements (e.g., “length of dry spell”, “number of days with PM10 exposure above 50 µg/m³”) would be a significant extension of the RRR, which currently focuses on observations;
- Capturing socio-economic data (e.g., population density; crop yield; value of infrastructure) is outside of the scope of the current RRR approach.

As a source of case studies, the publication “Climate ExChange”⁹ which contains more than 70 case studies for climate services was analyzed by a break-out group, with the aim to identify two case studies for each GFCS priority area, one describing a typical developed country scenario, one a typical developing country scenario.

The Team supported the approach taken in this paper. It noted that several satellite agencies and other institutions have been studying the task at hand, and that these studies should inform this effort.

The Team decided that a reasonable approach would be to build on the case studies outlined in Climate ExChange. It further recommended that societal benefit studies by NASA, ESA, ISRO and CSA could also be considered.

The group noted that the important value of seasonal forecasts recognized for many case studies. A number of case studies were examined by the Team and the full analysis is provided below.

Seasonal Forecasts for Agriculture (p28 in Climate ExChange).

The case studies indicate that there is great value to have probabilistic forecasts and that precipitation estimates particularly valuable. SST data are needed to support ENSO predictions. ECMWF, UKMO and others are major providers of such forecasts. ICPAC facilitate consensus seasonal forecasts in East Africa. The impact of satellite data on seasonal forecasts should be quantified.

Agriculture: Fisheries Management (p65 and p72)

Examples include the Bay of Bengal and Indonesia. The key challenges are overfishing, pollution, fish habitat degradation. The impact of climate change on fish stocks is difficult to quantify, let alone taking into account predictions. Acting upon these key challenges will mitigate likely impacts of climate change.

Recent trends include overfishing through a major increase in fishing activity. Satellite-based products are needed, including SST, ocean colour; wind, SSH (upwelling). MyOcean services are useful to fishing and for monitoring, control and surveillance mechanisms.

Water: North American Drought Monitor (p85)

Services are largely based on in-situ data with some satellite-derived input on precipitation. There is potential value to be derived from SMOS, GRACE and TRMM. This is a typical case for a region with high density of in-situ data which is not necessarily transferrable to other regions where there is limited availability of such data.

Health / Water Resource Management (p114)

Seasonal forecasts use ingested satellite data for meteorological and hydrological forecasts. Forecasts have proven important for predictability and subsequent management of epidemic

⁹ Climate ExChange (WMO 2012; Tudor Rose, 288pp.): http://www.wmo.int/pages/gfcs/casestudies_en.php

outbreaks (DVF, malaria) due to combined effects of temperature and precipitation. Forecasts are also important for water management of river dams for hydropower and agriculture downstream.

Energy

Solar energy resource assessment can be based on satellite products. A useful reference is Eckman and Stackhouse, Applied Energy (2011): *CEOS Contributions to informing energy management and policy decision-making using space-based Earth observations*.

The Team recognised the potential benefits of further work on the case studies and recommended a task group be set up to tackle this task. The intended audience of these case studies may include GFCS delegates, end users looking to justify investments in satellite reception or processing and satellite providers to make their case for the Architecture.¹⁰

ACTION 7.7: ET-SUP task group (R. Eckman in Lead; J.-L. Fellous, I. Gitonga, A. Rea, Secretariat) to develop a paper demonstrating the value of satellite data for the GFCS. Deadline: 15 Dec 2013.

7.3 Marine/JCOMM

J.-L. Fellous described current activities and prospects of satellite oceanography applications, and some current issues faced by this community. He mentioned ongoing efforts to launch a GHRSSST-type activity in the area of ocean surface winds, noting the accomplishments achieved within GHRSSST in integrating SST datasets from a variety of sources. GHRSSST has been communicating with the JCOMM Expert Team on Operational Ocean Forecasting Systems (ETOofs) and WMO and GCOS to review and meet requirements for ocean modelling.

Examples for ocean scatterometer, SST and SSH applications were given. He described open-ocean altimetry mission planning, the CEOS OST Constellation, and reprocessing of radar signals from near coastlines which now enable deriving storm surge wave heights and other coastal research and applications. SAR was also mentioned as an important source of measuring wind speeds.

JCOMM established a Task Team on Satellite Data Requirements in 2010. Taking the recently emerging issues into consideration, the JCOMM Management Committee assigned this Task Team to focus on integration of in-situ and satellite data to improve products and associated services, in particular, facilitating integration of ocean surface vector wind (OSVW) activities. However, it was noted that the Task Team has not yet fully established nor delivered a plan toward "open and transparent generation of high quality, user-friendly OSVW datasets" to be made available through the GTS, FTP, EUMETCAST and other means.

Other activities extend to capacity development of marine forecasters in the use of satellite-derived information.

Discussion in the session revealed that a three-altimeter constellation appears to provide adequate sampling for the derivation of sea surface topography.

ET-SUP noted that it is part of deliberations of the WMO/CGMS International Winds Working Group to discuss ocean surface winds.

Recommendation 7.7: The JCOMM Management Committee (MAN) is encouraged to pursue the establishment and effective functioning of the Task Team on Satellite Data Requirements (TT-SAT), with continuous review of its work plan that should be associated with related activities (e.g. International Ocean Vector Wind Science Team).

¹⁰ Training: COMET published in 2012 an online module called Monitoring the Climate System with Satellites. There are other modules with satellite related information and 33 modules on various Climate topics available at MetEd site (www.meted.ucar.edu).

7.4 Aviation/Volcanic Ash

R. Eckman provided an overview of current activities to derive volcanic ash from satellite observations, and related mission planning. These extend to the level of ICAO and WMO on the user coordination and regulation side to efforts on the part of satellite agencies to develop prototype services. The CEOS Atmospheric Composition Constellation has been coordinating satellite agency activities including in this area for several years. EUMETSAT (based on MSG and Metop), ESA (through the Support to Aviation Control Service, among others), NASA, JMA and NOAA NESDIS all have ongoing product developments in support of volcanic ash detection.

The Team emphasized the value of active systems, for example the CATS aerosol lidar to be deployed on the ISS. As for EarthCARE, near-real time data provision should be encouraged. There are a number of other relevant instruments to be launched in the near future, such as DSCOVR and SAGE III.

7.5 Status report on FY-2F

X. Fang gave a status report on the FY-2F geostationary system which is the first satellite in a new series. He introduced improvements with the VISSR instrument, such as full disc and intensive regional scans, higher temporal resolution, and more accurate spectral calibration with implication for cloud classification. He showed examples for geophysical products derived from FY-2F (tropical cyclone mapping, heavy rainfall) and the status of data dissemination using CMACast. For a period, there will be parallel operations of FY-2E, and FY-2F.

8. SATELLITE DATA FOR NWP AND RESEARCH

Under this agenda item, participants provided perspectives on the use of satellite data in the context of numerical weather prediction, research and development.

8.1 Satellite Data Assimilation at ECMWF

S. English highlighted the current use of satellite data at ECMWF and the expected developments in the near future, with implications for ECMWF data requirements. ECMWF collaborate closely with other weather and space agencies and hence their requirements reflect very closely the requirements of a wider community, although ECMWF are known for being pioneering in the use of new observations, and consequently are tackling some issues likely to become important to other agencies in the near future. Furthermore ECMWF often take on the work to evaluate and monitor research satellite observations, and can provide feedback on these datasets. Past examples include the AIRS instrument, now used at most state-of-the-art centres. Currently ECMWF are taking a lead on new active instruments such as EarthCARE and Aeolus. Nonetheless, considerable resources are still required to maintain the existing satellite observations that have a major impact on forecast accuracy, such as microwave sounders.

The presentation focussed on areas of particular interest to ECMWF, and areas that received particular attention during the past year. These include:

- The use of data from Metop-B and S-NPP
- Use of OceanSat OSCAT data
- Evaluation of FY-3 data
- Increased use of sounder data over sea ice and cold seas
- Advances in Principal Component assimilation for IASI
- Improved AMV assimilation

The spread in the analysis is based on a 25-member ensemble. It was suggested that additional GNSS-derived radio occultations (up to 10 000 in total per day) would have significant impact on reducing the spread in forecast ensembles.

S. English provided examples where providing feedback to instrument operators on data quality, e.g. when assimilating Metop-B GRAS data, has been used to confirm that data quality was equivalent to Metop-A. There are some issues with radar altimetry coverage since currently only Jason-2 is available; therefore efforts are ongoing to look into using CryoSat-2 altimeter data which is now available as a global marine product.

EarthCARE radar and lidar data may be available in near real time, with key contribution by ECMWF in preparing the assimilation system.

The discussion highlighted weaknesses of the data assimilation systems in assimilating water vapour frequencies in tropical regions. It was clarified that currently available microwave sounder data are under-utilized, therefore no firm statement can yet be made on the benefits of an additional low-inclination mission. However, sounder data from the Megha-Tropiques satellite are being evaluated.

8.2 Satellite Data Utilization at UKMO

S. Keogh showed an overview of the satellite data used at the UK MetOffice to support NWP, forecasting applications (using imagery), ocean forecasting, and climate applications.

For NWP, there have been recent successful efforts to operationally assimilate data from CrIS and ATMS on board Suomi-NPP. This work brought many challenges not only in terms of the exploitation of the instrument data but also in terms of the upgrade of the UKMO reception infrastructure to receive the X-band direct broadcast from the satellite.

Another recent highlight for NWP is the operational assimilation of data from Metop-B (e.g. IASI), the second satellite in EUMETSAT's polar orbiter series.

UK MetOffice is also exploring the use of Chinese satellite data, in particular atmospheric motion vectors (AMVs) over the Indian Ocean where it is known that AMVs in that area derived from Meteosat-7 are of poorer quality than desirable. Results show that recent improvements in the quality of FY-2E winds in particular could make these data useful for NWP assimilation purposes.

In terms of forecast imagery applications, significant recent developments have taken place to improve the volcanic ash imagery to now include quantitative information on ash size, ash column loading and ash top height. The SWIFT desk system is used for displaying imagery for forecasters. There has also been exploration of the use of VIIRS data for weather and the production of novel day/night band imagery forecasting (for detecting low-lying clouds, and fog at nighttime) as well as the use of imagery derived from FY-3 X-band direct broadcast data.

The use of satellite data for ocean forecasting (in particular sea surface temperature and height measurements) and climate applications (e.g. radiation budget) was also presented. The Operational SST and Sea Ice Analysis (OSTIA) system was mentioned as an important resource. Through FOAM (Forecasting Ocean Assimilation Model), measurable benefit of using ocean colour in an operational framework could be shown.

The Team highlighted that Metop-B-ATOVS data were made available by EUMETSAT very quickly such that they could be assimilated within 120 days of launch.

Recommendation 7.8: Satellite operators should make near-real time datasets from new missions available to users as soon as possible even if the data are still under evaluation (noting that EUMETSAT made pre-operational Metop-B data available within about two weeks after launch). This enables users to test their reception, processing, archiving and analysis systems.

S. Keogh further concluded that it would be useful to have an additional geostationary satellite over the Indian Ocean which produces good quality AMVs and offers DCP communications services. Additionally, the use of products is not only driven by their quality, but also by their accessibility, documentation, format and ease of integration with existing systems (e.g. forecaster desktops). Such documentation should wherever possible be standardized.

The Team raised concerns about the proliferation of data formats in which satellite datasets are being made available. In addition to WMO-agreed standards, many other data formats are in common use. It was noted that “specialized user” tend to prefer BUFR (sounder), HDF (imagery) whereas “generalized users” may prefer GEOTiff or netCDF. There were also different flavours of the “standardized” format in circulation, such as BUFR. It was suggested that metadata template for mission data should be available ahead of the launch date.

Results of a break-out group discussion on data formats are reported under item 17.

8.3 Report from the World Climate Research Programme

On behalf of the WCRP Joint Planning Staff, S. Bojinski briefed the group on applications of satellite data in projects supported by the WCRP. The use of remote-sensing observations was illustrated in the context of the Coordinate Regional Climate Downscaling Experiment (CORDEX) highlighting the growing need for high-resolution satellite data for regional climate applications. WCRP activities rely significantly on satellite-derived added-value products developed and validated through careful re-processing and evaluation exercises, and exploited within numerical models via reanalysis to produce optimal estimates of the Earth system for target historical periods.

Distributed archive systems make these model and observational datasets available to the community via the Earth System Grid Federation in an effort referred to as obs4mips. Intercomparisons of reanalyses with model output are now facilitated through the ana4mips initiative.

The Team welcomed the report on WCRP activities and asked whether the approach taken in obs4mips in standardizing and managing datasets could be adopted for harmonized representation of satellite datasets in contexts other than climate research, such as for SCOPE Nowcasting.

9. ‘SCOPE’ INITIATIVES

This item presents two WMO-led initiatives aiming at sustained, coordinated processing of environmental satellite data, with (9.1) focussing on the generation of climate data records and elevating the scientific and operational maturity of such records, and (9.2) targeting the use of satellite products in nowcasting applications. SCOPE-CM entered phase 2 in 2013 and a close-out summary report on its projects was provided. SCOPE-Nowcasting is in its formative stage, and a thorough discussion on the proposed pilot projects, commonalities, and next steps is required.

9.1 SCOPE-CM Update

S. Bojinski briefed the group on the on the results of the first phase of the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) initiative 2008-2012 and the current status of projects submitted to the SCOPE-CM Executive Panel for phase 2 in response to a Call for Proposals issued in January 2013.

The first phase of SCOPE-CM 2008-2012 was guided by an implementation plan¹ and focussed on five pilot projects in order to establish partnerships and coordinate activities within SCOPE-CM. These were:

Pilot Description	Partners
Pilot 1: AVHRR based dataset of cloud and aerosol properties	NOAA (proposal coordinator) + EUMETSAT (CM-SAF)
Pilot 2: SSM/I: total column water vapour, precipitation, liquid water path	NOAA + EUMETSAT (CM-SAF) (proposal coordinator) + CMA ((precipitation)
Pilot 3: Surface albedo, clouds + aerosols from geostationary satellites	JMA + EUMETSAT (Central Facilities (proposal coordinator) + CM SAF) + NOAA + CMA
Pilot 4: Atmospheric Motion Vectors (AMV) + clear sky radiance	JMA (proposal coordinator) + EUMETSAT (Central Facilities) + NOAA + CMA
Pilot 5: Upper tropospheric humidity	JMA + EUMETSAT (CF + CM SAF) + NOAA (proposal coordinator) + CMA

Results of these pilot projects are reported in the SCOPE-CM Phase 1 Close-out document given in the Appendix of ET-SUP-7/doc. 9.1.

Eligibility criteria for projects in phase 2 of SCOPE-CM state that projects are to:

- address user needs such as coming from analysis of climate variability and trends, model-based reanalysis, climate modelling and evolving (environmental and) climate services;
- address the generation of satellite CDRs (including Essential Climate Variables as identified by GCOS) from multi-agency satellite data and/or employing several satellite CDR generation capabilities and/or several algorithms;
- aim at increased maturity in CDR generation through coordination and cooperation across space agencies, participating institutions and organisational boundaries;
- expect to benefit from SCOPE-CM coordination among space agencies as well as other relevant international organisations and initiatives;
- Research Institutions as well as satellite operators and space agencies (operational and research) can be involved in SCM Projects.

As specific goals, future projects should:

- enable and support coordination and cooperation activities to increase maturity of satellite CDR capabilities;
- transfer activities of the SCOPE-CM Pilot Projects of Phase I (2009-2012) into the Phase 2;
- foster the extension of the network with respect to participating institutes and groups, geophysical parameters (ECVs) and satellite sensor data;
- foster the collaboration between research institutions and satellite agencies in CDR generation;
- answer to priorities and opportunities identified by the relevant communities, in particular: Coordination Group for Meteorological Satellites (CGMS) recommendations to address
 - precipitation related ECVs
 - preservation of pre-1979 data records
- Extend the use of the Global Space-based Inter-Calibration System (GSICS).

A total of 10 proposals were received, and evaluated by the SCOPE-CM Executive Panel at its meeting on 22 February 2013. The Panel requested clarifications and updates for a number of proposals. It is planned to finally endorse projects as contributing to SCOPE-CM phase 2 by June 2013. The first set of progress reports from the projects is expected to be available by April 2014.

The Team raised questions on the relationship of SCOPE-CM to work undertaken in the WCRP Global Data Assessment Panel (GDAP) and the CEOS VCs. SCOPE-CM provides an umbrella to coordinate climate data record generation essentially from the meteorological constellation of

satellites. The Team recommended that exchange of expertise and coordination with these mechanisms should be ensured (one phase 2 proposal involves ISCCP datasets). It was further noted that the CEOS Executive Officer is invited to future meetings of the SCOPE-CM Executive Panel.

9.2 SCOPE-Nowcasting

9.2.1 Status

A. Rea recalled the SCOPE-Nowcasting concept with its goal to provide a mechanism through which satellite data could be made available simply and quickly, arising out of earlier ET-SUP discussions. Basic nowcasting products (e.g., RGBs, imagery), advanced products (e.g., fog detection, cloud products), real-time ocean products, atmospheric composition products (e.g., dust products). He outlined the proposed pilot projects which were then reported on in more detail.

9.2.2 Pilot Projects

H. Kunitatsu presented on a prototype Aeolian dust product being trialled for implementation on Himawari-8 data. The product is based on the GOES-R algorithm, and is being tested using MODIS data.

Luiz Machado presented on the pilot project relating to global rainfall estimates based on geostationary and low-Earth orbiting satellites. A prototype product based on geostationary IR imagery is available through a web mapping interface at: <http://sigma.cptec.inpe.br/scope/>

M. Koenig (via teleconference) pointed out that distribution of software in NWC-SAF occurs for good reasons since regional tuning is very important. The SWFDP Project on Lake Victoria in the context of a regional warning system was also considered.

The Team discussed the idea that SCOPE-Nowcasting should be seen as an umbrella group to support the development of satellite-based products.

The SCOPE-Nowcasting Concept and a broad definition of the Pilot Projects are presented in the ET-SUP-6 and-7 documents. However, the Team felt it necessary to provide clearer and more specific project definitions to facilitate the move from draft concepts to project proposals that could be realized. Therefore, two actions were proposed:

- 1) To discuss the SCOPE-Nowcasting concept in the joint session of ET-SAT and ET-SUP to test the idea with the satellite operators and to check if it is possible to propose some recommendations to the next CGMS. The Team agreed that the success of SCOPE-Nowcasting will be dependent on commitments from the satellite operators in the conceptualisation and preparation of the Pilot Project proposals.
- 2) To submit to each Pilot Project to the following questions and criteria to ensure that each Pilot Project has a more precise definition and to facilitate the preparation of a more detailed Proposal.

The following criteria for SCOPE-Nowcasting projects were suggested:

- a. use of multi-satellite data;
- b. dataset formats can be read by standard tools;
- c. concise (<2 pages) product documentation including a description on: general product characteristics, data format, data fields, originating satellite datasets, algorithm, validation and uncertainty estimate, limitations;
- d. open and easy access;
- e. available in near-real time (<6h);
- f. availability of training information; and
- g. an official commitment from all agencies involved in the project.

In addition, the Team suggested that the following questions should be asked for each pilot project:

- a. are the multi-satellite data consistent?
- b. what is the source of dataset and products?
- c. are the products validated and is there an error estimate?
- d. what are the limitations of the product?
- e. what is the timeliness?
- f. how will the data be available to the users?
- g. who are the users?
- h. what basic infrastructure is required to use the data?
- i. how is the product used?
- j. can the product be used in combination with others providers' products?
- k. what is the Pilot Project timetable?
- l. how can users be trained in use of the product?

Consistent with the SCOPE-Nowcasting Concept of Operations, the Team also restated that data providers involved in pilot projects may distribute processing software which host agencies can use to themselves generate products, using raw satellite data distributed by the providers.

The Team further reviewed the draft list of pilot projects using the abovementioned criteria, with the following results:

Pilot Project 1: Basic Nowcasting

In preparation for the next generation of geostationary imagers, the group decided that RGB composites would be an appropriate target product for this pilot. The reasons for this decision are:

- (i) There is a de facto standard for RGBs in existence which has been generated by EUMETSAT and endorsed by WMO. In September 2012, a WMO/EUMETSAT RGB workshop¹¹ was held and attended by representatives of CMA, JMA and KMA; the workshop reiterated the validity of these standards;
- (ii) None of the satellite operators in RA II and RA V currently deliver RGB products in real time;
- (iii) The next generation of geostationary satellites in the region - Himawari-8, FY-4A and Geo-KOMPSAT-2A – will provide an appropriate platform for delivery of these products.

Action 7.8: In consultation with CMA, JMA and KMA, to develop (i) a product specification document, and (ii) a product dissemination plan, for harmonized RGBs for nowcasting from imagers on Himawari-8, FY-4A and Geo-KOMPSAT-2A. Lead: A. Rea; Co-Leads: H. Kunimatsu, X. Fang.

Pilot Project 2: Advanced Nowcasting

In this category, the group decided that a globally-consistent volcanic ash product (from GEO and LEO) would be an appropriate target product for this pilot. The reasons for this decision are:

- (i) There is a clear need expressed by ICAO for a consistent product to be made available globally;
- (ii) A number of centres have made recent advances in developing satellite-based volcanic ash products; these could form the basis of a standard;
- (iii) More global coordination is required;
- (iv) The need for this activity has been recognized by CGMS¹².

¹¹ http://www.wmo.int/pages/prog/sat/documents/RGB-WS-2012_FinalReport.pdf

¹² Recommendation 40.27 (CGMS-40, 2012): "The scientific development (EUMETSAT, JMA, NOAA joint development of common/consistent volcanic ash products) should be considered as a pilot activity of SCOPE-Nowcasting."

Action 7.9: ET-SUP Chair and WMO Secretariat to explore how SCOPE-Nowcasting could be recognized as a catalyst for attaining globally harmonized satellite-based volcanic ash products for nowcasting. (contact points: D. Lockett, H. Pümpel (WMO); Andrew Tupper (BoM))

Pilot Project 3: Advanced Nowcasting: Precipitation / Severe Rainfall Risk Reduction

The group felt that this project has made good progress and that its efforts should be encouraged. In particular, the additional use of microwave data in an integrated product should be considered. Contingency measures should be developed with regard to the launch of GPM. Formal agreement from data providers (NOAA, NASA, and JAXA) should eventually be sought.

No further action arising at this point.

Pilot Project 4: Real-time Ocean Products

As framed, this project does not address the criteria and considerations outlined above. The project plan should be revised to include real-time provision of ocean winds from multiple sources, including Metop/ASCAT, Oceansat-2/OSCAT and HY-2A/SCAT, with the possible addition of AMV data.

Action 7.10: Designated leads for the SCOPE-Nowcasting Pilot Project 4 (Ocean Winds) to revise the plan to include real-time provision of ocean winds from multiple sources, including Metop/ASCAT, Oceansat-2/OSCAT and HY-2A/SCAT, with the possible addition of AMV data. Deadline: 1 Sep 2013

Pilot Project 5: Real-time Atmospheric Composition Products: Sand and Dust Forecasting

H. Kunimatsu (JMA) and X. Fang (CMA) agreed to progress this initiative through the implementation of Aeolian dust products based on a common algorithm. The initial focus is on deriving aerosol optical depth, with other aerosol parameters to be encompassed at a later stage. Common cloud masks should be developed and distributed as appropriate with regard to user needs. JMA have conducted experiments applying the GOES-R dust algorithm to the provisional response function of Himawari-8/AHI with closest MODIS channels as pseudo data. JMA will validate the algorithm with surface observation data using Himawari-8 data after the launch of Himawari-8. It was agreed that this approach could also be adopted by CMA for FY-4A. KMA may consider doing the same for Geo-KOMPSAT-2A. Appropriate synergy with the RGB dust product derived in Pilot Project 1 should be achieved.

Action 7.11: JMA and CMA to carry out test studies based on the GOES-R dust algorithm towards application to Himawari-8 and FY-4A data, and to compare results under a range of meteorological conditions.

Action 7.12: A. Rea to update the SCOPE-Nowcasting Concept to reflect the discussions at ET-SUP-7, and to develop a high-level summary of the Concept. Deadline: 1 Sep 2013.

10. FACILITATING ACCESS TO DATA, PRODUCTS, AND TOOLS

Under this item, the session reviewed online resources developed by the Secretariat to facilitate access to satellite data, products, and processing and analysis software tools: the [Product Access Guide](#) (10.1) , the [data access and software tools webpage](#) and the [OSCAR capabilities and requirements database](#) (10.2).

10.1 Product Access Guide

N. Hettich recalled the motivation for developing an online Product Access Guide, with the objective to provide a top-level overview and guidance on available, quality-controlled product

collections, and to enhance the visibility for products, with an initial focus on satellite-based products. He noted some of the challenges encountered in developing the Guide, such as the diversity of taxonomies used by the various product providers, and the structure of their individual online catalogues. The revised Product Access Guide allows for more flexibility in discovering products (by domain, application, region, and source) in that it assigns “tags” to product collection links. A database of product collection links and associated tags can be used as a source, for example for the dynamic generation of websites; it could also link to other resources such as training material, expert groups.

S. Wannop stated that EUMETSAT were committed to follow the Product Access Guide model in Q3/Q4 2013 through a dedicated amendment to the EUMETSAT Product Navigator.

The Team recommended that terminology for describing product and product collections should follow existing WMO standards where possible (the WMO Official Meteorological Terminology in METEOTERM and, as appropriate, GEMET (General Multilingual Environmental Thesaurus)).

Recommendation 7.9: All satellite operators intending to make their products discoverable through the Product Access Guide should follow the requirements specified in the PAG Concept and Specification Document (Appendix B in ET-SUP-7/doc. 10.1).

10.2 Facilitated Access to Data and Tools

N. Hettich introduced the OSCAR concept and demonstrated its utility in an online session by showing an example for the stored observation requirements, and the discovery possibilities for satellite capabilities including variable-based gap analyses. He also showed the status of the current data access and tools page. For better integration of data access information, he raised the possibility of including these links in OSCAR.

The Team recommended that data access information should be integrated into OSCAR, by default at programme level, with satellite-level deviations provided in a free text field. Information on processing and analysis tools should remain available separately on a dedicated website. More action should be taken to advertise OSCAR in the community, through space agency and user webpages, letters to WMO PRs, brochures. Concerns about the ability to maintain the tool in the long term were raised.

Action 7.13: WMO Secretariat to integrate data access information currently available on a static webpage into OSCAR. Deadline: 1 Nov 2013

Action 7.14: WMO Secretariat to distribute promotional material on OSCAR through letters to WMO PRs, to the co-chairs of the International Scientific Working Groups, and through emails to user communities. Deadline: End 2013

Action 7.15: Members of ET-SUP to advertise the OSCAR tool through their own communication channels. Deadline: 1 Oct 2013

11. INTERACTION WITH SATELLITE AGENCIES (JOINTLY WITH ET-SAT)

The session met jointly with the WMO CBS Expert Team on Satellite Systems (ET-SAT) for briefings by satellite operators on their programmes. A summary of these presentations follows:

Zhansheng Chen (China National Space Administration) outlined plans for China’s polar orbiting and geostationary meteorological satellites. The presentation highlighted the planned 2015 launch of FY-4A which will feature an advanced imager, infrared sounder and lightning mapper. Plans for a FY-4 microwave mission, currently scheduled for 2020 were also outlined. Several application areas for geostationary imagery and derived products were demonstrated.

Mr Chen also detailed the plans for the FY-3 series of polar orbiting satellites, the planned launch of FY-3C in October 2013 and future plans for a FY-3 rainfall monitoring mission in 2017.

Guennadi Kroupnik (Canadian Space Agency) provided an overview of current and planned Canadian satellites, in particular the Radarsat Constellation Mission (RCM) and the Polar Communications and Weather (PCW) mission. The PCW mission has completed Phase A, with an accompanying business case and evaluation of socio-economic benefits. This evaluation, performed by EuroConsult, will be shared openly in NH autumn 2013. The details of the payload for PCW have not yet been decided; however, it is expected to provide imagery with a refresh cycle of 15 minutes above 50°N. The RCM data policy is being negotiated with the partners in industry. The aim is to make available global SAR data as broadly as possible.

Mr Kroupnik also provided details of the Chemistry and Aerosol Sounding Mission (CASS), which has been developed in direct response to GCOS/CEOS actions. The mission is seeking international partnerships.

Kenneth Holmlund (EUMETSAT) provided an update on plans for the Meteosat and Metop series of satellites. It was noted that Indian Ocean Data Coverage is not guaranteed beyond 2016. Mr Holmlund also provided an update on the Antarctic Data Acquisition initiative for Metop and noted that average timeliness of the global data has been significantly reduced.

The continuation of the tandem Metop operations was discussed and highlighted benefits for NWP (dual sounders), ozone, and the generation of global AMVs.

Recommendation 7.10: EUMETSAT to provide an update on the Antarctic Data Acquisition initiative at the next session of ET-SUP regarding timeliness of data delivery and further development of the service.

Yasushi Izumikawa (Japan Meteorological Agency) updated the meeting on plans for Himawari-8 and -9, with Himawari-8 scheduled for launch in 2014 and operations in 2015. Himawari-8 will feature an imager very similar to the GOES Advanced Baseline Imager.

A 2-day training event on Regional readiness, to be held in conjunction with the 4th Asia/Oceania Meteorological Satellite Users' Conference (9-11 October 2013), was also discussed.

Albrecht von Barga (Deutsches Zentrum für Luft- und Raumfahrt DLR) provided an update on the German space programme, including TerraSAR-X and TanDEM-X, and the planned EnMap and Merlin missions.

Jack Kaye (NASA) provided an update on NASA mission planning. Support for ground validation networks and airborne campaigns were also highlighted as critical activities. The Cyclone Global Navigation Satellite System (CYGNSS) constellation of 8 microsatellites will support tropical cyclone understanding and monitoring. The TEMPO geostationary atmospheric composition mission was outlined – it is awaiting an opportunity to be installed as a mission of opportunity on a commercial satellite.

Riko Oki (JAXA) described the Japan Space Basic Plan 2013-2017 which has as its priority subjects: national security and disaster management, development of industry and space science frontier. A key focus is ensuring autonomy in Earth observation data. Two major missions are being prepared for launch: ALOS-2, with a wide swath high resolution L-Band SAR, and the GPM core observatory, with the Ku/Ka Dual-frequency Precipitation Radar, which will be launched early 2014.

Standard products and research products from JAXA spacecraft were described, and Ms Oki provided a number of data access weblinks. An example for application of satellite data in flood

forecasting and warning was given. Access to GCOM-W1 data via EUMETCast will be progressed through a EUMETSAT/JAXA bilateral this NH summer.

On behalf of Sid Boukabara (NOAA), Lars Peter Riishojgaard presented an update on NOAA satellites status and plans. Slides on the significant impact of satellites on forecasting skill were shown. It was noted that operations for GOES-R are scheduled to commence in 2017.

Dr Riishojgaard noted that JPSS-1 is scheduled for early 2018 launch and that there could be a data gap if Suomi-NPP does not last beyond its design life of 5 years. It was also noted that the Defence equivalent of JPSS, DWSS, has been cancelled and current plans are to continue operations with DMSP until 2025. However, DMSP has no sounder, and atmospheric sounding is not a core requirement for DMSP.

The current plans for COSMIC-2 were also discussed. There is an agreement between the USA and Taiwan, China on COSMIC-2. Operations for low-inclination orbits are scheduled to commence in 2016 and high-inclination orbits in 2018. Processing for COSMIC-2 will be handled by UCAR. The current COSMIC constellation is down to 3-4 satellites, from an original six.

On behalf of Dohyeong Kim (KMA), Jerome Lafeuille presented on the satellite status and plans of KMA. COMS now takes an extended Northern Hemisphere observation every 15 minutes. Some research into integration of COMS data and ground observations for nowcasting (COMS and AWS, COMS and radar) was shown.

KMA plan to operate Geo-KOMPSAT-2A with an Advanced Meteorological Imager (AMI) similar to ABI and a space weather sensor in 2017. The satellite has a planned 10-year life. Geo-KOMPSAT-2B with an Ocean and Environment sensor will be launched in 2019. KMA is also developing plans for a LEO towards a launch tentatively in 2020.

11.2 Atmospheric Composition Requirements and Space Capabilities

R. Eckman provided the joint session with a briefing on Atmospheric Composition Requirements and Space Capabilities. The presentation covered the CEOS Atmospheric Composition Constellation (ACC), one of seven virtual constellations that assemble a set of space and ground segment capabilities operating together in a coordinated manner to meet a combined and common set of Earth observation requirements. The goal of the ACC is to collect and deliver data to develop and improve predictive capabilities for changes in the ozone layer, air quality, and climate forcing associated with changes in atmospheric composition.

ACC addresses the following elements to meet the science discipline and application requirements by its member agencies:

- (i) Develop a consensus for priorities based on emerging societal needs and established user requirements from both operational and research communities;
- (ii) Determine if there are inconsistencies or deficiencies among the various requirements and reconcile differences if necessary;
- (iii) Evaluate existing and upcoming missions, both operational and research, and compare with requirements;
- (iv) Define enhancement in the area of calibration/validation, quality control, and data accessibility and interoperability;
- (v) Establish how existing and approved missions could work synergistically to meet the international user community requirements and in particular the GEOSS societal benefit areas; and
- (vi) Develop rationale and strategy for new mission(s) to meet existing requirements not being met and for possible new requirements.

Some of the known issues facing the atmospheric sciences applications communities for remotely sensed measurements include:

- (i) Continuity of trace gas stratospheric measurements involved in ozone chemistry. These are needed to better understand trends and to quantify the effectiveness of the Montreal protocol;
- (ii) Accurate and continued monitoring in the upper troposphere/lower stratosphere, with high vertical resolution, for climate research and applications;
- (iii) Improved accuracy and coverage of radiatively active gases and aerosols in the boundary layer needed for surface flux assessment and aerosol/cloud formation. These remain the largest uncertainties in climate forcing;
- (iv) Short- and long-term temporal and spatial variation measurements of radiatively and chemically active trace gases and aerosols to determine their impact on air quality for improved inventories, predictions, and assessments;
- (v) Tracking trans-continental and trans-oceanic transport of tropospheric pollutants and their precursors; and
- (vi) Interoperability of atmospheric composition data across existing and planned missions.

Since 2007, the ACC has held annual or semi-annual meetings of its members to respond to its goals and near-term CEOS needs. These include representatives from national space agencies and researchers from academia. Typical meeting attendance has ranged from 30-50 individuals.

In 2008, ACC met at NASA GISS and reviewed atmospheric chemistry and climate model requirements and assessed space-based measurement gaps. The workshop produced a report which includes a set of prioritized recommendations, based on expected data gaps of atmospheric composition, for future missions. While this report is now five years old, many of its recommendations remain relevant and useful for consideration by the community.

Subsequent meetings addressed the coordination of a future Air Quality constellation based on geostationary satellites planned and in development by Korea (GEMS), ESA (Sentinel-4), NASA (GEO-CAPE and TEMPO), and Japan (GMAP-Asia). The missions would be planned to take advantage of their synergistic capabilities. Cost efficiencies might be achieved if there are common instrument requirements.

Coordinated algorithm development, data content and format, and calibration/validation were planned. A community-developed white paper was delivered to the CEOS Strategic Implementation Team in 2010 for consideration and endorsement (http://ceos.org/images/ACC/AC_Geo_Position_Paper_v4.pdf).

The near-term recommendations of this paper are currently being implemented through ACC and by the relevant mission science teams.

R. Eckman indicated he would welcome any involvement in an update of internationally-coordinated, community-based observation requirements for atmospheric composition, such as given by the 2005 IGACO report. He also confirmed that care must be applied in interpreting instrument gap analyses, noting the difference between specialized instruments (built for the purpose of measuring a particular variable) and secondary instruments (useable for measuring a particular variable, but not designed specifically for that purpose). J. Lafeuille recalled that the atmospheric composition segment of the WMO Vision for WIGOS in 2025 was still very preliminary, and the session agreed that it would be useful to elaborate it further, based on updated requirements and expected technology.

Jack Kaye noted that the community should not lose focus on the value of in situ observations and highlighted the deployment of ozone sondes as an essential complement to satellite missions, and in some ways preferable to additional, lower-quality, satellite-based ozone sensors.

It was noted that the GMES Pure project led by EUMETSAT was investigating the translation of service-driven requirements into data requirements which is of potential interest to showing the linkage of GFCS to satellites and the Architecture for Climate Monitoring from Space (see item 7.2).

11.3 Satellite Utilization Matters for Attention by Agencies

A. Rea provided an overview of ET-SUP for ET-SAT members. He recalled the mandate of ET-SUP and its work plan, and outlined its membership and coverage of a broad spectrum of application areas. He summarized the course of discussions held earlier in the week and outlined a number of issues that the ET-SUP members had wished to raise with agency representatives on ET-SUP.

The work of the break-out groups was described with preliminary results in the areas of SCOPE-Nowcasting, data format harmonization, and case study analysis in GFCS priority areas.

For SCOPE-Nowcasting, A. Rea went into some detail on the criteria that nowcasting products should fulfil, such as multi-satellite origin, sufficient documentation, adequate training, and rapid delivery. The guidance of ET-SAT was sought on whether stringent requirements should be specified for the SCOPE-Nowcasting products. In response to a question on whether SCOPE-Nowcasting should take a more forward-looking view on the future of nowcasting products (such as their delivery in combination with model outputs, or as level 1 datasets, for example), A. Rea indicated that SCOPE-Nowcasting was focused on areas where the science was already mature.

The broad categories for SCOPE-Nowcasting products were outlined and ET-SAT members suggested that a clear requirement for products needed to be established.

Regarding simplification of data formats, he reported on early results of ET-SUP thinking regarding criteria that data formats should meet.

W. Zhang mentioned the Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) Task Team on the WIGOS Metadata, working on the development of common metadata for all WIGOS observations. Since this Task Team currently does not have a satellite community representative, focal points from ET-SUP (and ET-SAT) should follow its discussions.

Action 7.16: ET-SUP members to identify focal points in their institution that could provide input related to satellite data to the ICG-WIGOS Task Team on the WIGOS Metadata. Deadline: 30 June 2013.

It was further noted that the WMO Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM) maintains WMO standard data formats. The meeting recognized that different user communities favour different data formats; satellite providers struggle to meet all user requirements in this regard and are sometimes forced to disseminate native formats as a base level product (see item 17).

Other issues raised in the meeting were:

- (i) potential issues with commercialization of satellite operations and impacts on free exchange of data between WMO members;
- (ii) issues with the proliferation of DVB-S/S2 systems in RA II and RA V;
- (iii) the need for coordination of data processing and dissemination efforts for GPS-RO missions of opportunity.

A. Rea also mentioned that it would be desirable to have interleaved 5-minute scanning from two different platforms; however, it was pointed out that this may be technically challenging due to parallax errors caused by different viewing angles and differences in navigation.

Discussion

The meeting discussed a number of additional matters of mutual interest. The issue of near-real-time dissemination of R&D mission data was raised – this does not always occur even if the data contributes to the WMO GOS, in which case near-real-time dissemination is mandated.

Delays can be attributed to a number of factors. In many cases, verification of proper instrument functioning needs to first occur before investments in large-scale data dissemination can be justified. It was stressed that requirements for near-real-time dissemination should be addressed in the design stage for a mission, as retrofitting this capability can be difficult or impossible.

The impact of the Antarctic Data Acquisition Service (ADA) for Metop on direct readout was discussed. It was noted that ADA does not remove the need for RARS. The ADA is expected to continue; however, EUMETSAT relies on international partnerships to operate the receiving stations.

Update on CIMO Guide (Lafeuille, ET-SAT-8/doc 8.3)

J. Lafeuille provided a short summary on the impending update of the satellite observation part of the Guide on Instruments and Methods of Observation (the “CIMO Guide”) which contains chapters on principles of basics of satellite remotes sensing, satellite observation techniques, calibration and validation and the range of application areas of satellites in meteorology and related fields. This guide is expected to be completed by September 2013 for submission to CIMO in 2014, and should then provide a useful reference material for satellite users.

Feedback from ET-SUP on Joint Session with ET-SAT:

Overall the team reported positive feedback, and members found the briefings from the satellite operators very useful and informative. It was suggested that a 1-page update in consistent style and content per satellite agency could be made available one week ahead of the meeting, to shorten agency presentations and allow for more discussion in the joint session.

Action 7.17: WMO Secretariat to develop a template for the 1-page update provided by satellite agencies at future joint ET-SAT/ET-SUP sessions.

It was also suggested that the joint session with ET-SAT could be run as a panel session with keynote speakers followed by questions from the floor.

Recommendation 7.11: In the future, joint meetings of ET-SAT and ET-SUP should be considered, possibly including a panel for discussing matters of mutual interest.

12. DATA DISSEMINATION AND IGDDS UPDATE

This agenda item addressed data dissemination techniques for existing and planned missions, including software tools made available by satellite agencies to enable data access. An overview of the Integrated Global Data Dissemination Strategy (IGDDS) was provided, along with a report on GEONETCast. ET-SUP Members will be asked to share brief, factual information on data access from particular satellite systems. This was complemented by a report on the Regional ATOVS Retransmission Service ([RARS](#)).

12.1 IGDDS including GEONETCast

12.1.1 GEONETCast Status, EUMETCast Update

GEONETCast is a distribution system for GEOSS resources using commercial communications satellites and low cost, self contained, stand alone off-the-shelf reception stations. GEONETCast is a GEO Task and will be featured at GEO Ministerial Summit 2014.

S. Wannop also updated the group on the status of EUMETCast. A training channel on EUMETCast will be published soon, where training material (documentation, test datasets, webcasts, software) is being disseminated along with datasets.

EUMETSAT has joined the International Charter on Major Disasters and besides being a data provider, EUMETSAT will use its EUMETCast system to support the dissemination of charter data. In the near future, EUMETCast-Europe will comprise a basic service and a high-volume service using DVB-S2 standards. Parallel operation of the legacy and new service is foreseen. S. Wannop outlined the implications for users associated with the transition to this service, mostly affecting the receiver device and not the receiving antenna. Information on the transition is available on the EUMETSAT website.

In addition, there is data exchange between CMA and EUMETSAT where, CMA are distributing EUMETSAT products on CMACast and CMA products are transmitted on EUMETCast, and likewise between EUMETSAT and NOAA. In the case of the EUMETSAT-CMA data exchange, user management and interaction is handled by the satellite operator providing the data services (i.e. EUMETSAT handles user access for users receiving EUMETSAT data via CMACast). In the case of the EUMETSAT-NOAA exchange, a small set of essential EUMETSAT products are disseminated in the clear on GEONETCast-Americas.

12.1.2 GEONETCast-Americas Status

GEONETCast-Americas (GNC) is a suitable, low-cost tool for making datasets available in areas with poor internet connectivity. A station can be installed at a cost of less than USD \$5000 per unit. Twenty-nine receiving stations have been installed by NOAA, USAID or GNC-Americas partners.

One of the primary uses of GNC is in support of disaster risk reduction, e.g. in the case when other telecommunication systems are affected by a disaster. This is relevant in invoking the International Charter on Major Disasters which is opening its user base to recognized national disaster response authorities. Training is another important use of the GNC.

The opinion that many countries would purchase low-cost GEONETCast receiving stations if they knew they could expect a reliable data stream through these systems was highlighted at the 2013 NOAA Satellite Conference and was a view shared by many countries in the Americas.

12.2 RARS

S. Uspensky described the ground segment maintained by SRC Planeta which is the satellite division of ROSHYDROMET. The acquisition strategy is based on a range of priorities and mostly includes NOAA, NASA and EUMETSAT satellites. Preparation is ongoing to prepare for Suomi-NPP data on the EUMETSAT Advanced Retransmission Service.

It was suggested that the Regional ATOVS Retransmission Services (RARS) infrastructure could also be used as a basis for a SCOPE-Nowcasting initiative.

The group recognised that a clear directive from the NWP community on the expansion of RARS to incorporate hyperspectral sounder data such as from NPP/CrIS. RARS station receiving capability in X-band was needed for this purpose. In this context, additional WMO Secretariat leadership is required to advance the further international coordination. The greater IGDDS and its continuing relevance should also be revisited in the context of the evolving WIS.

In addition, EUMETSAT informed about a project to establish RARS in Africa with the installation of three new RARS stations (L/X-band). Implementing three RARS stations in Africa would complement coverage of the region, taking into account existing nearby RARS stations in La

Réunion, Maspalomas, Oman and Athens. Potential station locations being considered are South Africa, Gabon and Kenya. It is anticipated that the South African Weather Service (SAWS) play a lead role within the region.

The EUMETSAT contribution to the RARS in Africa during the development phase (procurement, installation, start of operation) will be to:

- Provide technical advice to the RARS stations hosting entities for the procurement, installation and then operation of the stations;
- Facilitate contact between the various stakeholders (e.g. SAWS, hosts of RARS stations, etc.);
- Support the search of the location for the two other stations, and ensuring that all requirements for an operational service are met (inc. telecommunication aspects);
- Support mobilisation of funds for the procurement, installation and operation of the new stations.

During the operational phase (once the station is integrated in the RARS network), EUMETSAT's role will be the same as for all the other "non-European" stations of the EARS network, with expected support from South Africa.

The high-level planning currently assumes the incorporation into RARS of the existing L-band station in Cape Town by the end of 2013, with other activities being addressed by end 2016.

Recommendation 7.12: ET-SUP stressed that RARS should be continuously supported and that the expansion of RARS services to incorporate hyperspectral sounder data, transmitted either in L or X-band, required additional efforts.

12.3 Update on new capabilities

Not discussed.

13. TRAINING AND EDUCATION: VIRTUAL LABORATORY

The session reviewed the overall progress made by the Virtual Laboratory for Education and Training in Satellite Meteorology ([VLab](#)) over the past year, in particular the results of the 6th meeting of the Virtual Lab Management Group meeting. ET-SUP was also informed on future plans including: future local or regional training events, activities of regional focus groups, event weeks, and expansion of the VLab to new centres of excellence and application areas.

13.1 VLab Status and Plans

Since January 2013, VLab members have offered a variety of training opportunities with highlights being the WMO/NOAA Train the Trainer Workshop for WMO RA III/IV, the Precipitation Event Week, the Virtual Round Table on Competence Requirements for Aeronautical Meteorological Personnel, the World Weather Briefing the Satellite Direct Readout Event. In particular, the Precipitation Event Week attracted 300-400 participants from 33 countries.

The World Weather Briefings consisted of nine online sessions focusing on challenges that forecasters have to face around the globe. The presenters from Canada, USA, Brazil, Portugal, Oman, South Africa, Germany, Russia, South Korea and Australia guided the audience through region-specific weather characteristics. The Briefings had 448 participants from 34 countries, which is an excellent turn-out.

Furthermore, important developments have taken place since ET-SUP-6, including the CBS endorsement of the application by DMN Casablanca to become a VLab Centre of Excellence

(CoE), the establishment of the WMO VLab Trust Fund to collect funds for the continuation of the employment of the VLab Technical Support Officer (TSO), and the sixth Virtual Laboratory Management Group meeting (VLMG-6) held in October 2012 in São José dos Campos, Brazil.

Coordination with partner programmes includes COSPAR and EUMETCal.

In this briefing, V. Gärtner stressed the value of the VLab in creating synergy between what exists in terms of distant learning and training resources worldwide, being able to reach out to virtually every WMO Member country. The development of Conceptual Model for the Southern Hemisphere, with participation by Argentina, Brazil, South Africa, and Australia serves as an example where the VLab infrastructure helps leveraging individual resources. Sustained technical support to the VLab was recognized as a resource essential for the functioning of the VLab.

Recommendation 7.13: ET-SUP recommended that CGMS operators provide regular annual contributions to the WMO VLab Trust Fund in order to ensure sustained technical support to the VLab.

13.2 COMET Update

T. Mostek briefed the group on the various resources used for the NOAA satellite proving ground, VISIT and COMET/MetEd. NOAA has imposed severe budget cuts in COMET and VISIT funding.

In summary, NWS funding for VISIT ends in Fiscal Year 2013. There is some suggestion that the GOES-R program will help to support and maintain the website.

With regard to COMET®, the funding model has been 100% government funding, 60% from NOAA (NWS and NESDIS) and 40% Other (State Dept., MSC, Navy, DOI, WMO). The new funding model includes the private sector, donations, and more reliance on international activities. NWS has funded all COMET® administration, budget, and IT costs since inception in 1990. This peaked at nearly \$2M/year in FY 2009, and has been dropping rapidly since that time.

Recommendation 7.14: ET-SUP expressed its concern about the immediate threats to the COMET resource given its essential role for the VLab, and encouraged all efforts to restore funding to a level necessary for its continuing functioning.

13.3 COSPAR

J.-L. Fellous illustrated the activities of the Committee of Space Research and its capacity building programme in the area of Earth science. COSPAR has developed with various partners a series of capacity building workshops and an associated fellowship programme that are aimed at conveying practical knowledge in areas of interest to COSPAR and at building lasting bridges between scientists. Capacity building workshops occur roughly three times in every two-year period. Successful students in these workshops can apply for the COSPAR fellowship programme.

Since its inception in 2001, 17 capacity building workshops have been held in various parts of the world, a large fraction of them covering astronomy and other domains of space physics. In recent years, a significant effort has been devoted to extending the scope of these workshops in the field of Earth sciences, as is shown by the following list:

In view of this programme and in consideration of the mutual interest in training and capacity building, an agreement has been signed on 21 March 2012 by the Director of the WMO Space Programme and the President of COSPAR with the goal of jointly promoting such activities. The first co-sponsored event was the Beijing capacity building workshop held in September 2012.

The team recommended that collaborative training activities between COSPAR and the VLab should be fostered and training materials shared.

Recommendation 7.15: Collaborative training activities between COSPAR and the VLab should be fostered and training materials shared.

14. REGIONAL EVENTS

This agenda item consisted of brief reports on regional events relevant to ET-SUP.

14.1 2013 NOAA Satellite Conference and associated WMO-NOAA Train the Trainer event

T. Mostek gave an overview of key results and recommendations from the 2013 NOAA Satellite Conference and the associated WMO/NOAA regional “Train the Trainers” Event¹³, as presented in the closing session of the Conference.

14.2 4th Asia/Oceania Meteorological Satellites Users’ Conference

A. Rea briefed the Group on the upcoming 4th Asia Oceania Meteorological Satellites Users Conference, to be held in Melbourne, Australia, on 9-11 October 2013. The second announcement and call for papers will be issued next week. Further details are available from: <http://www.virtuallab.bom.gov.au/events/aomsuc/>. A training event hosted by the BoM VLab Centre of Excellence, in cooperation with JMA, focussed on next-generation imagers and with emphasis on users in RA V will be held on 7-8 October 2013.

14.3 2013 EUMETSAT Meteorological Satellite Conference

S. Wannop gave an overview of the plans for the 2013 EUMETSAT/AMS Meteorological Satellite Conference and the session topics to be addressed by the Conference. This will be a joint event, hosted by EUMETSAT, ZAMG – Austrian NMHS, the European Meteorological Society, the American Meteorological Society and NOAA. The venue is the Hofburg Palace, Vienna, Austria and dates 16-20 September 2013.

Presentations so far include 408 talks and 272 posters submissions.

15. INTERNATIONAL SCIENTIFIC WORKING GROUPS

This item provided a short brief on the status and planned meetings of the International Scientific Working Groups (ITWG, IWWG, IROWG, IPWG) co-sponsored by WMO and CGMS.

15.1 International TOVS Working Group (ITWG)

S. English briefed the group on outcomes of the ITSC conference held in 2012 with relevance to ET-SUP.

The ITWG is a sub-group of the CGMS and the International Radiation Commission (IRC). The outcomes and actions from the last ITSC meeting organised by the ITWG were summarised in the working group report available at the ITWG website, <http://cimss.ssec.wisc.edu/itwg/itsc/itsc18/index.html>.

¹³ <http://satelliteconferences.noaa.gov/2013/>

ITWG has six sub working groups that meet at each ITSC and form their own individual working group report. The ITWG co-chairs then consider these reports and summarise the major outcomes into a series of major recommendations that are presented to the CGMS.

The last meeting of ITWG, ITSC-18, was held in Toulouse, France and hosted by MétéoFrance and 22 key recommendations were made. Examples include consideration of the optimal orbital configuration for sounders and a request for access to Russian data.

15.2 International Precipitation Working Group (IPWG)

V. Gärtner provided an update and overview of the IPWG. The IPWG was established under CGMS to:

- (i) promote standard operational procedures and common software for deriving precipitation estimates from satellites;
- (ii) establish standards for validation and independent verification of precipitation estimates;
- (iii) foster the exchange of data on inter-comparisons of operational precipitation estimates from satellites;
- (iv) stimulate increased international scientific research and development in this field;
- (v) provide recommendations to national and international agencies regarding the utilization of current and future satellite instruments on both polar and geostationary platforms; and
- (vi) encourage regular education and training activities.

IPWG accomplishments include

- (i) conducting the survey on applications of satellite-derived precipitation products and publishing the list of adequate datasets;
- (ii) survey of different sources of validation rainfall data, according to Recommendation No 3 from IPWG-5 Validation Working Group Meeting;
- (iii) publishing at the IPWG web page the lists of publicly available, quasi-operational and quasi-global precipitation datasets;
- (iv) leadership of Group on Earth Observations (GEO) precipitation subtask;
- (v) Interactions with Working Group on Numerical Experimentation (WGNE) on satellite precipitation validation using NWP generated precipitation estimates.

The 6th IPWG Meeting was held in Sao Paulo in October 2012 and was hosted and sponsored by CPTEC/INPE. 55 Participants from 14 countries attended. The meeting featured working group sessions on Research & New Technologies, Validation and Application.

In discussion, the team recommended that IPWG establish stronger links to the NWP community as NWP moves towards quantitative precipitation forecasting and assimilation of rainfall information.

15.3 International Winds Working Group (IWWG)

The Secretariat presented some background on IWWG which was established in 1991 and became a formal working group of the Coordination Group for Meteorological Satellites (CGMS) in 1994. The group currently has 50-60 active members. The IWWG web site/wiki is: <http://cimss.ssec.wisc.edu/iwwg/iwwg.html>

The group provides a forum to discuss and coordinate operational and research developments in satellite-derived wind data production, verification/validation procedures, and assimilation techniques. Areas covered include:

- (i) Geostationary and polar imagery (clouds and water vapour);
- (ii) Radar backscatter & conical microwave radiometers (ocean surface winds);
- (iii) Research instruments (i.e., MISR);and

- (iv) Future instruments (advanced imagers, space-borne lidar, GEO-hyperspectral)

The 11th IWW was held in February 2012 and hosted by the University of Auckland, New Zealand. It was attended by 56 scientists and covered:

- (i) updates on operational products;
- (ii) latest developments in AMV derivation, characterisation, NWP applications;
- (iii) one session focussed on MISR winds;
- (iv) one session focussed on Doppler Wind lidar;

In addition to usual working groups, the meeting held focused group discussions on:

- (i) NWP winds impact study and high resolution winds;
- (ii) AMV intercomparison plan and simulated data studies; and
- (iii) AMV open source software.

15.4 International Radio Occultation Working Group (IROWG)

The Secretariat reported on the Second IROWG Workshop which was held in Colorado, USA from 28 March to 3 April 2012. It was attended by more than 70 scientists. All major centres providing and/or assimilating data were present. In total, three working papers were prepared for submission to CGMS-40:

- (i) Report from the 2nd International Radio Occultation Workshop, CGMS-40 EUM-WP-01;
- (ii) Status of the global Radio Occultation Observing System, CGMS-40 EUM-WP-02; and
- (iii) Climate related Processing and Potential of Radio Occultation Data, CGMS-40 EUM-WP-03.

The first working paper summarized the workshop, including actions and recommendations, while the second and third respond to specific CGMS-39 actions. All working papers are available at <http://www.irowg.org/workshops.html>.

The RO community at IROWG-2 focused on three main recommendations to convey to CGMS:

- (i) There is a need for an operational continuity plan for radio occultation – including troposphere and ionosphere – to provide a daily availability of at least 10,000 occultations;
- (ii) There is an urgent need to fill a data gap, using research or opportunity satellites, or commercial sources (if available) for the near term, but this should not replace a long-term continuity plan to provide operational GNSS radio occultation data; and
- (iii) CGMS agencies should engage in re-processing of radio occultation data to maximize their utility in anchoring climate reanalyses.

The meeting requested WMO to coordinate impact studies, through the CBS, in order to update and refine its requirements for GNSS radio-occultation (e.g. number of occultations/day, distribution in space). ET-SUP supports this recommendation. ECMWF have done some research to define the optimum number of occultations for numerical weather prediction.

Recommendation 7.16: ECMWF to participate in internationally-coordinated observing system simulation experiments to determine the optimal GNSS-RO constellation, in line with CGMS Action 40.23.

16. CGMS-41

The Team was informed of plans for the 41st session of the Coordination Group for Meteorological Satellites, to be held in Tokyo 8-12 July 2013, and related WMO input to the session. The WMO Space Programme and ET-SUP Chair will be in attendance and will provide a number of user-focused presentations. ET-SUP highly welcomed the planned participation by the Chair in CGMS-41.

17. REPORTS OF BREAK-OUT GROUPS

Based on the discussions during the previous agenda items, break-out groups were formed during the session of ET-SUP-7 on specific topics. These groups reported back to plenary on the results of their work. In total, six break-out groups were formed over two sessions.

The subjects and composition of the breakout groups was as follows:

Session 1 (Tuesday p.m.)		Session 2 (Thursday a.m.)	
1. SCOPE Nowcasting – Pilot Projects	Luiz Machado Hiroshi Kunimatsu Xiang Fang Daniele Biron Volker Gärtner	4. WMO Survey Analysis	Jean-Louis Fellous Simon Keogh Stephen English Sergei Uspensky
2. Data Formats – Issues and Recommendations	Simon Keogh Stephen English Sally Wannop Sergei Uspensky	5. Regional Requirements Gathering	Luiz Machado Sally Wannop Ignatius Gitonga
3. GFCS – Review of Case Studies	Ignatius Gitonga Richard Eckman Jean-Louis Fellous Stephan Bojinski	6. SCOPE-NWC - Workplan	Hiroshi Kunimatsu Xiang Fang Richard Eckman Daniele Biron Anthony Rea

Summaries of the findings of the break-out groups are provided under the respective agenda items where applicable:

- SCOPE-Nowcasting: item 9.2
- GFCS – Review of Case Studies: item 7.2
- Survey Analysis: item 5
- Regional Requirements gathering: item 6.2

Break-out group on Data Formats – Issues and Recommendations

The Team identified a number of issues relating to data formats for direct dissemination and formulated a draft list of properties that an ideal dataset should embody. The properties of an ideal data format were then rated from 1 to 3 in terms of the level of challenge to implement (level 1: very challenging; 2: moderately challenging; 3: not very challenging). Ultimately, such a data format would enable the current proliferation of data formats to be reduced. BUFR format was also rated against the desirable properties. This is captured in the following table.

Properties of an “ideal data format”	Level of Challenge	BUFR?
Agreed at WMO level	1	✓
Self describing	3	✗
Compressed (lossless) as much as possible	2	✓
Visualizeable using standard tools	2	✗
Rapid change management process	1	✗
Easy to read/write/test using standard tools	2	✗
Agreed well in advance of data flowing from the instrument	3	✓
Platform independent	3	?
Fast I/O	3	✓

Easy to segment/reconstruct	2	x
Agreed metadata standard	3	x
NRT , archive and retrieval suitability	3	✓
Easy to subsample	2	x

The group examined a subset of the highly challenging items and realized that further work would be required to refine the list of requirements for an ideal data format, and to take steps toward its realization.

Action 7.18: ET-SUP to identify amongst its members leaders for a task team further developing the satellite user perspective on data formats. Linkage to existing frameworks such as the WMO IPET-DRMM and the CEOS WGISS should be sought. Deadline: 30 June 2013.

D. Biron agreed to participate in this activity.

18. ANY OTHER BUSINESS

No other business was recorded.

19. REVIEW AND ADOPTION OF THE DRAFT REPORT

The Secretariat provided a draft report of the session, for initial feedback by participants.

20. DATE AND PLACE OF NEXT MEETING

The meeting agreed that the next meeting of the Team should be in roughly one year, at WMO HQ in Geneva.

In terms of its working modalities, the Team decided to meet via telephone conference nominally every three months. The first teleconference shall be held between 25 August and 6 Sept, at 12.00 UTC. An additional teleconference shall be scheduled 10-14 days prior to the next session of ET-SUP.

21. CLOSURE OF THE MEETING

The session closed at 16.00 on Thursday, 30 May 2013.

APPENDIX I

WORK PLAN FOR THE ET-SUP FOR THE PERIOD 2012-2014 (FROM ICT-IOS-7 DOC. 6.6) (LAST UPDATE: 19 DEC 2012)

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
1	Monitor the progress of satellite data availability and use by WMO Members, related issues and expectations, with the aim to publish findings and recommendations in a WMO document	Biennial survey Analysis of responses Findings and recommendations Advice to Regional Associations on follow-up actions WMO document for publication Next survey	2012/2 2012/4 2012/4 2012/4 2013/1 2015	WMO SP Secretariat and ET-SUP	2012 Survey completed;	
2	Provide advice and support to the development and implementation of WIGOS, from a satellite user's perspective and coordinate with ET-SAT and ET-EGOS on the evolution of the space-based component of Global Observing Systems;	Contribute to the evolving EGOS IP, the Manual on the GOS, the Vision for the GOS 2025, and the WIGOS IP Support WMO Programmes (both operational and research) in their satellite data and product-related needs	2012/2 and as required Continuous	ET - SUP and WMO SP Secretariat	Revision to EGOS-IP approved at ET- EGOS in May 2012	
3	Initiate and promote activities to improve the availability of operational and R&D satellite data according to user needs, monitor these activities in close coordination with the relevant CGMS working group(s) and with WIS activities;	Promote the development and maintenance of Regional Satellite Data Requirements in all Regions, as appropriate Provide feedback on the progress of IGDDS and RARS Guide and assist new Regional Satellite Requirements Coordination Groups	2013 onwards	ET - SUP and WMO SP Secretariat, with assistance from Int'l WGs IGDDS and RARS implementation groups	Interaction with ITWG, IWWG, IPWG, IROWG, Nowcasting and other expert groups strengthened Partnership with SWFDP reinforced	
4	Review present and future R&D satellite data and products including their availability and potential applications, and provide advice with a view of increased utilization by WMO Members;	Review of relevance and availability of R&D satellite data, based on global/regional requirements; Strengthen interaction with R&D agencies in the area of altimetry, soil moisture, precipitation, and climate Make recommendations for improved availability, information and training, especially for developing countries	Ongoing	ET - SUP and WMO SP Secretariat	Participation in relevant fora (CHy, Altimetry Symposium); International Soil Moisture Workshop planned for Jul 2013, ESA Living Planet Symposium 2013)	

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5	Review and assist in addressing the needs of WMO Members for information regarding access to and utilization of satellite data and products;	Maintain a list of satellite data access points, processing and analysis software tools on WMO webpage Include updated list of VLab-relevant tools	2012/3 (continued yearly)	ET - SUP and WMO SP Secretariat	Collection of information initiated	
6	Promote development and harmonization of satellite data and products responding to WMO Members' needs	Continue to provide guidance to phase 2 of Sustained Co-ordinated Processing of Environmental Satellite Data (SCOPE) for Climate Monitoring as a key contribution to the architecture for climate monitoring from space. Assess and further the concept of SCOPE for Nowcasting, through pilot projects Develop Product Access Guide, in coordination with satellite operators	2013/1 (call for proposals) 2013 (prototype developed) 2013 (updated version published)	ET - SUP and WMO SP Secretariat and responsible for the SCOPE-NWC projects	Pilots Projects defined and agreed First version on WMO SP website	
7	Keep under review the needs of WMO Members for training in satellite meteorology and related fields, and engage with the Management Group of the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) to address these needs, towards full utilization of satellite data from operational and R&D satellites, in accordance with the 2009-2013 Virtual Laboratory Training Strategy;	Regular reviews of the VLab status, activities and plans (training resources, courses, meetings, newsletters); Support existing VLab CoEs and the establishment of new ones; Provide guidance to meet users' needs, especially from less developed Members and for the next generation of satellites; Explore training partnerships Contribution to training resource development	2012/3 (continued yearly) 2013/1 2013/1 and continuing 2013-2014 Continuous activity	VLMG, WMO SP Office and ET-SUP	VLMG meeting in October 2012 held; virtual meetings every 3 months Candidature of CoE Morocco agreed; launch event CBS Guidance developed; follow-up to be defined based on Members' needs WMO-COSPAR MoU signed; joint activities in 2013 in planning stage.	

APPENDIX II

LIST OF PARTICIPANTS

Dr Anthony Rea (Chair)
Bureau of Meteorology
GPO Box 1289
MELBOURNE 3001 VIC
Australia
Tel: +61 (3) 9669 4222
Fax: +61 (3) 9669 4168
Email: a.rea@bom.gov.au

Dr Daniele Biron
Centro Nazionale Meteorologia Climatologia Aeronautica
Via Pratica di Mare, 45
00040 POMEZIA (RM) IT
Italia
Tel.: +39 33469 33631
Fax: +39 06912 93419
Email: biron@meteoam.it

Dr Richard Eckman
National Aeronautics and Space Administration (NASA)
Atmospheric Composition Modeling and Analysis Program,
Earth Science Division, Science Mission Directorate
Mail Suite 3B74
WASHINGTON D.C. 20546-0001
United States of America
Tel.: +1 202 358 2567
Fax: +1 202 358 2770
Email: richard.s.eckman@nasa.gov

Dr Stephen English
ECMWF
Shinfield Park
READING RG29AX
United Kingdom
Tel.: +44 1189 49660
Email: Stephen.English@ecmwf.int

Dr Xiang Fang
Division of Remote Sensing Data Applications
National Satellite Meteorology Centre
China Meteorological Administration
46 Zhong Guan Sun Nandajie
Haidian District
BEIJING 100081
China
Tel: +86 (10) 6840 6553
Fax: +86 (10) 6217 5936
Email: fangxiang@cma.gov.cn

APPENDIX II

Dr Jean-Louis Fellous
JCOMM and COSPAR representative
Committee on Space Research (COSPAR) c/o CNES
2 Place Maurice-Quentin
PARIS 75039 Cedex 01
France
Tel: +33 1 44 76 75 81
Fax: +33 1 44 76 74 37
Email: jean-louis.fellous@cosparhq.cnes.fr

Dr Volker Gärtner
EUMETSAT Representative
EUMETSAT
Eumetsat-Allee 1
D-64295 DARMSTADT
Germany
Tel: +49 (6151) 807 3690
Fax: +49 (6151) 807 3040
Email: [volker.gaertner \[at\] eumetsat.int](mailto:volker.gaertner[at]eumetsat.int)

Mr Ignatius Gitonga Gichoni
Kenya Meteorological Department
P.O. Box 30259
NAIROBI
Kenya
Tel: +254 20 386 7880
Fax: +254 20 387 6955
Email: gitonga@meteo.go.ke
natius7@yahoo.com

Dr Simon Keogh
Head Satellite Data Processing Systems Group
Met Office
FitzRoy Road
EXETER EX1 3PB
United Kingdom
Tel.: +44 (0)1392 886067
Fax: +44 (0)1392 885681
Email: simon.keogh@metoffice.gov.uk

Dr Hiroshi Kunimatsu
Meteorological Satellite Center
Japan Meteorological Agency
3-235 Nakakiyoto, Kiyose-shi
TOKYO 204-0012
Japan
Tel: +81 42 493 4973
Fax: +81 42 492 2433
Email: kunimatu@met.kishou.go.jp

APPENDIX II

Dr Luiz Augusto Toledo Machado
Instituto Nacional de Pesquisas Espaciais (INPE)
Centro de Previsão de Tempo e Estudos Climáticos (CPTEC)
Rodovia Presidente Dutra, Km 40
12630-000 CACHOEIRA PAULISTA/SP
Brazil
Tel: +55 12 3186 9399
Fax: +55 12 3186 9291
Email: Luiz.Machado@cptec.inpe.br

Mr Anthony J. Mostek (*joined by phone for items 12.1.2, 13, 14.1*)
Forecast Decision Training Branch
NOAA - National Weather Service
3085 Center Green Drive
BOULDER, CO 80301
United States of America
Tel: +1 303 497 8490
Fax: +1 303 497 8491
Email: Anthony.Mostek@noaa.gov

Dr Lars Peter Riishojgaard
Chair, ICT-IOS
Director, Joint Center for Satellite Data Assimilation
National Center for Weather and Climate Prediction
5830 University Research Court,
COLLEGE PARK MD 20740
United States of America
Tel.: +1 301 683 3615
Fax: +1 301 763 8149
Email: lars.p.riishojgaard@nasa.gov

Dr Sergei Uspensky
SRC PLANETA
ROSHYDROMET
7, Bolshoy Predtechenskiy Per
123242 MOSCOW
Russian Federation
Tel: +7 (499) 795 2112
Fax: +7 (499) 252 6610
Email: uspenskys@planet.iitp.ru

Ms Sally Wannop
EUMETSAT Representative
EUMETSAT
Eumetsat-Allee 1
64295 DARMSTADT
Germany
Tel: +49 6151 807 4400
Fax: +49 6151 807 3040
Email: sally.wannop@eumetsat.int

WMO Secretariat

Dr Stephan Bojinski
Space Programme
Observation and Information Systems Department
Tel: +41 22 730 8319
Email: sbojinski@wmo.int

Mr Nils Hettich
Space Programme
Observation and Information Systems Department
Tel: +41 22 730 8292
Email: nhettich@wmo.int

Mr Jérôme Lafeuille
Space Programme
Observation and Information Systems Department
Tel: +41 22 730 8228
Email: jlafeuille@wmo.int

Dr Peiliang Shi
Director, WIS Branch
Observation and Information Systems Department
Tel: +41 22 730 8219
Email: pshi@wmo.int

Dr Wenjian Zhang
Director
Observation and Information System Department
Tel: +41 22 730 8567 Email: wzhang@wmo.int

AGENDA AND WORK SCHEDULE

MONDAY, 27 MAY 2013

*Approx. Time
incl. Discussion*

8:30	Registration (Salle 7 JURA)	
9:00	1. ORGANIZATION OF THE SESSION	20'
	1.1 Opening of the session (Chair); Welcoming Remarks (WMO)	
	1.2 Adoption of the agenda	
	1.3 Working arrangements for the session	
9:20	2. CHAIRMAN'S REPORT (Rea)	10'
	2.1 Outcome of relevant meetings since ET-SUP-6	
9:30	3. GUIDANCE FROM THE CHAIRPERSON OF OPAG IOS (Riishojgaard)	10'
9:40	4. UPDATE ON WIGOS AND GFCS (Secretariat)	
	4.1 WIGOS (Zhang)	15'
	4.2 GFCS (Lucio)	15'
10:10	5. WMO 2012 SURVEY ON THE USE OF SATELLITE DATA (Secretariat)	30'
10:40	<i>Break</i>	20'
11:00	6. DATA ACCESS AND EXCHANGE REQUIREMENTS	
	6.1 NAEDEX-APSDEU (Rea; English)	15'
	6.2 Regional coordination mechanisms and user perspectives	
	6.2.1 Procedure on Regional Requirements for Satellite Data Access and Exchange (Secretariat)	10'
	6.2.2 RA I: RAIDEG (Wannop), KMD perspective (Gitonga)	20'
	6.2.3 RA II WIGOS Project (Kunimatsu)	20'
	6.2.4 RA III/IV (Machado)	20'
	6.2.5 RA V (TT-SUR) (Rea)	20'
12:45	<i>Lunch Break</i>	75'
14:00	7. SATELLITE DATA FOR APPLICATIONS	
	7.1 Nowcasting (Rea)	20'
	7.2 Climate/GFCS (Secretariat)	20'
	7.3 Marine/JCOMM (Fellous; Lee)	20'
	7.4 Aviation/Volcanic ash (Eckman; Pümpel)	20'
	7.5 Status report on FY-2F (Fang)	10'
15:20	8. SATELLITE DATA FOR NWP AND RESEARCH	
	8.1 Satellite Data Assimilation at ECMWF (English)	20'
	8.2 Satellite Data Utilization at UKMO (Keogh)	20'
16:00	<i>Break</i>	20'
16:20	8.3 Report from the World Climate Research Programme (Rixen)	20'
16:40	9. 'SCOPE' INITIATIVES	
	9.1 SCOPE-CM Update (Schüller/Secretariat)	10'
	9.2 SCOPE-Nowcasting	
	9.2.1 Status (Rea)	10'

APPENDIX III

9.2.2 Pilot Projects (Rea; Kunimatsu; Fang; Gärtner) 30'

17:40 *Adjourn for Day 1*

TUESDAY, 28 MAY 2013

*Approx. Time
incl. Discussion*

9:00 **10. FACILITATING ACCESS TO DATA, PRODUCTS, AND TOOLS**
10.1 Product Access Guide (Secretariat) 30'
10.2 Facilitated Access to Data and Tools, and OSCAR (Secretariat) 20'

11. (INTERACTION WITH SATELLITE AGENCIES (WITH ET-SAT) – WED 29 MAY)

9:50 **12. DATA DISSEMINATION AND IGDDS UPDATE**
12.1 IGDDS, including GEONETCast
 12.1.1 GEONETCast Status (Wannop), EUMETCast Update (Wannop) 15'
 12.1.2 GEONETCast-Americas Status (Mostek) 15'
12.2 RARS (Uspensky) 20'

10:40 **Break** 20'

11:00 **12.3 Update on New Capabilities (All)** 20'

11:20 **13. TRAINING AND EDUCATION: VIRTUAL LABORATORY**
13.1 VLab Status and Plans (Gärtner) 30'
13.2 COMET Update (Mostek) 10'
13.3 COSPAR (Fellous) 10'

12:10 **14. REGIONAL EVENTS**
14.1 NOAA Satellite Conference and Training Event (Mostek) 5'
14.2 4th Asia/Oceania Meteorological Satellites Users' Conference (Rea) 5'
14.3 2013 EUMETSAT Meteorological Satellite Conference (Wannop) 5'

12:25 **15. INTERNATIONAL SCIENTIFIC WORKING GROUPS**
15.1 Current activities and plans in ITWG (English) 5'
15.2 Current activities and plans in IPWG (Gärtner) 5'
15.3 Current activities and plans in IWWG (Secretariat) 5'
15.4 Current activities and plans in IROWG (Secretariat) 5'

FORMATION AND BRIEFING OF BREAK-OUT GROUPS

13:00 **Lunch Break** 60'

14:00 **WORK IN BREAK-OUT GROUPS** 180'

17:00 **PLENARY REPORTS OF BREAK-OUT GROUPS** 45'

17:45 *Adjourn for Day 2*

WEDNESDAY, 29 MAY 2013

*Approx. Time
incl. Discussion*

ALL DAY : JOINT ET-SUP/ET-SAT SESSION (IN SALLE B)

9:00 **BRIEFINGS BY SPACE AGENCY REPRESENTATIVES IN ET-SAT (14x10-15 min)** 210'

APPENDIX III

12:30	<i>Lunch Break</i>	75'
13:45	11. ATMOSPHERIC COMPOSITION REQUIREMENTS AND SPACE CAPABILITIES (Eckman)	25'
14:20	SATELLITE UTILIZATION MATTERS, FOR ATTENTION BY AGENCIES (REPORT BY ET-SUP)	60'
15:20	<i>Break</i>	20'
15:40	DISCUSSION (All)	20'
16:00	SHORT AND LONG-TERM GAP ANALYSIS: RISKS AND MITIGATION	60'
17:00	<i>Adjourn for Day 3</i>	

THURSDAY, 30 MAY 2013

		<i>Approx. Time incl. Discussion</i>
9:00	16. CGMS-41 (Secretariat, Gärtner)	10'
9:10	BREAK-OUT GROUPS (if needed)	
10:30	17. REPORTS OF BREAK-OUT GROUPS	60'
11:30	18. ANY OTHER BUSINESS	15'
11:45	19. REVIEW AND ADOPTION OF THE DRAFT REPORT	45'
12:30	<i>Lunch Break</i>	60'
13:30	19. REVIEW AND ADOPTION OF THE DRAFT REPORT (cont'd)	75'
14:45	20. DATE AND PLACE OF NEXT MEETING	15'
15:00	21. CLOSURE	

ACTIONS FROM ET-SUP-7 AND PREVIOUS ET-SUP MEETINGS

I. Actions from ET-SUP-7
Action 7.1: All ET-SUP members to analyze the WMO 2012 Survey on the Use of Satellite Data, with particular focus on results specific to their Region; Members to provide feedback to the ET-SUP Chair and the Secretariat; Deadline: 1 Sep 2013.
Action 7.2: S. English and A. Rea to facilitate the invitation by CMA of an INPE/CPTEC observer to the next NAEDEX-APSDEU meeting in China 2014.
Action 7.3: Regional Satellite Data Requirements Groups should each designate a chair or co-chairs, if not already in place. Deadline: 1 Sep 2013.
Action 7.4: S. Wannop, L. Machado, A. Rea, H. Kunimatsu and X. Fang to agree on a common template for gathering requirements for data access and exchange, based on their respective practices. Deadline: 1 Dec 2013.
Action 7.5: RA II WIGOS Project co-leads (JMA and KMA) to address the deficiencies and challenges reported by Members in RA II in response to the 2010/2011 user survey. Deadline: 4 th AOMSUC in Oct 2013 (for development of a work plan)
Action 7.6: WMO Secretariat, in collaboration with RA II WIGOS Project co-leads (JMA and KMA), to invite Lao PDR to become a member of the Coordination Group for the Project. Deadline: 1 Sep 2013
Action 7.7: ET-SUP task group (R. Eckman in Lead; J.-L. Fellous, I. Gitonga, A. Rea, Secretariat) to develop a paper demonstrating the value of satellite data for the GFCS. Deadline: 15 Dec 2013.
Action 7.8: In consultation with CMA, JMA and KMA, to develop (i) a product specification document, and (ii) a product dissemination plan, for harmonized RGBs for nowcasting from imagers on Himawari-8, FY-4A and Geo-KOMPSAT-2A. Lead: A. Rea; Co-Leads: H. Kunimatsu, X. Fang.
Action 7.9: ET-SUP Chair and WMO Secretariat to explore how SCOPE-Nowcasting could be recognized as a catalyst for attaining globally harmonized satellite-based volcanic ash products for nowcasting. (contact points: D. Lockett, H. Pümpel (WMO); A. Tupper (BoM))
Action 7.10: Designated leads for the SCOPE-Nowcasting Pilot Project 4 (Ocean Winds) to revise the plan to include real-time provision of data from multiple sources, including ASCAT, Oceansat-2 and HY-2A, with the possible addition of AMV data. Deadline: 1 Sep 2013
Action 7.11: JMA and CMA to carry out test studies based on the GOES-R dust algorithm towards application to Himawari-8 and FY-4A data, and to compare results under a range of meteorological conditions (H. Kunimatsu, X. Fang).
Action 7.12: A. Rea to update the SCOPE-Nowcasting Concept to reflect the discussions at ET-SUP-7, and to develop a high-level summary of the Concept. Deadline: 1 Sep 2013
Action 7.13: WMO Secretariat to integrate data access information currently available on a static webpage into OSCAR. Deadline: 1 Nov 2013
Action 7.14: WMO Secretariat to distribute promotional material on OSCAR through letters to WMO PRs, to the co-chairs of the International Scientific Working Groups, and through emails to user communities. Deadline: End 2013
Action 7.15: Members of ET-SUP to advertise the OSCAR tool through their own communication channels. Deadline: 1 Oct 2013
Action 7.16: ET-SUP members to identify focal points in their institution that could provide input related to satellite data to the ICG-WIGOS Task Team on the WIGOS Metadata. Deadline: 30 June 2013.
Action 7.17: WMO Secretariat to develop a template for a 1-page update provided by satellite agencies at future joint ET-SAT/ET-SUP sessions.
Action 7.18: ET-SUP to identify amongst its members leaders for a task team further developing the satellite user perspective on data formats. Linkage to existing frameworks such as the WMO IPET-DRMM and the CEOS WGISS should be sought. Deadline: 30 June 2013.

APPENDIX III

Action 7.19: CMA VLab CoE to arrange for a distance lecture on the FY-3 product suite for the benefit of all Regions.
Action 7.20: VLab CoE at the Hydrometeorology University of St. Petersburg (Russian Federation) to arrange for a distant lecture on the Meteor-M product suite for the benefit of all Regions in conjunction with a training event in Russia in 2014.
II. Recommendations from ET-SUP-7
Recommendation 7.1: Global WMO surveys on the use of satellite data should be conducted roughly every four years.
Recommendation 7.2: Region-based efforts to improve the use of satellite data by Members should be informed by data from (i) global surveys and, as necessary, (ii) Region-specific surveys; case and country-specific follow-up is particularly encouraged.
Recommendation 7.3: Regional mechanisms fostering coordination of requirements for satellite data access and exchange should be strengthened by collocating, where possible: (i) region-based satellite user conferences; (ii) regional training events covering current and upcoming satellite systems, enabling users to utilize data from these systems, practical information on data access, visualization and analysis tools, and (iii) meetings of Regional Satellite Data Requirements Groups.
Recommendation 7.4: WMO has insufficient resources to fully support such events, therefore Members of the Regional Satellite Data Requirements Groups including satellite providers should consider providing additional resources.
Recommendation 7.5: Regional Satellite Data Requirements Groups should, at least initially, focus on access and exchange of (i) satellite data, or (ii) any data disseminated via satellite-based (DVB-type) services. As appropriate, the Groups should also work on a Region-based data dissemination plan, with cost/resource-sharing options to ensure sustainability of service.
Recommendation 7.6: Regional Satellite Data Requirements Groups should regularly report to ET-SUP.
Recommendation 7.7: The JCOMM Management Committee (MAN) is encouraged to pursue the establishment and effective functioning of the Task Team on Satellite Data Requirements (TT-SAT), with continuous review of its work plan that should be associated with related activities (e.g. International Ocean Vector Wind Science Team).
Recommendation 7.8: Satellite operators should make near-real time datasets from new missions available to users as soon as possible even if the data are still under evaluation (noting that EUMETSAT made pre-operational Metop-B data available within about two weeks after launch). This enables users to test their reception, processing, archiving and analysis systems.
Recommendation 7.9: All satellite operators intending to make their products discoverable through the Product Access Guide should follow the requirements specified in the PAG Concept and Specification Document (Appendix B in ET-SUP-7/doc. 10.1).
Recommendation 7.10: EUMETSAT to provide an update on the Antarctic Data Acquisition initiative at the next session of ET-SUP regarding timeliness of data delivery and further development of the service.
Recommendation 7.11: In the future, joint meetings of ET-SAT and ET-SUP should be considered, possibly including a panel for discussing matters of mutual interest.
Recommendation 7.12: ET-SUP stressed that RARS should be continuously supported and that the expansion of RARS services to incorporate hyperspectral sounder data, transmitted either in L or X-band, required additional efforts.
Recommendation 7.13: ET-SUP recommended that CGMS operators provide regular annual contributions to the WMO VLab Trust Fund in order to ensure sustained technical support to the VLab.
Recommendation 7.14: ET-SUP expressed its concern about the immediate threats to the COMET resource given its essential role for the VLab, and encouraged all efforts to restore funding to a level necessary for its continuing functioning.

APPENDIX III

Recommendation 7.15: Collaborative training activities between COSPAR and the VLab should be fostered and training materials shared.	
Recommendation 7.16: ECMWF to participate in internationally-coordinated observing system simulation experiments to determine the optimal GNSS-RO constellation, in line with CGMS Action 40.23.	
Recommendation 7.17: A roadmap towards a sustainable, enhanced DVB-S service covering RAIII and RA IV should be developed and implemented through discussions among NOAA, INPE, EUMETSAT, GEO and other interested parties, facilitated by WMO as appropriate.	
III. Actions from ET-SUP-6	
ET-SUP-6 Action 6.30: A. Mostek, with assistance from COMET and the WMO Space Programme office, to investigate whether ESRC (as a portal) and MetEd (as a repository of training material) can be registered in appropriate ways in the WIS, to allow for broad discovery of their content. (Due date: 1 March 2012).	OPEN;